Final Report

DEVELOPMENT OF FLIGHT-SAFETY PREDICTION METHODOLOGY FOR U. S. NAVAL SAFETY CENTER

February 1970

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U. S. NAVAL SAFETY CENTER
Norfolk, Virginia

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This final report describes the activities of ARINC Research Corporation pursuant to the development of a flight safety measurement and prediction capability for the U. S. Naval Safety Center.

The methodology developed encompassed functional analysis of the F-4J aircraft, assessment of the importance of safety-sensitive functional paths, and the construction and exercising of a mathematical model to arrive at a numerical measurement of the safety criticalities of aircraft equipments.

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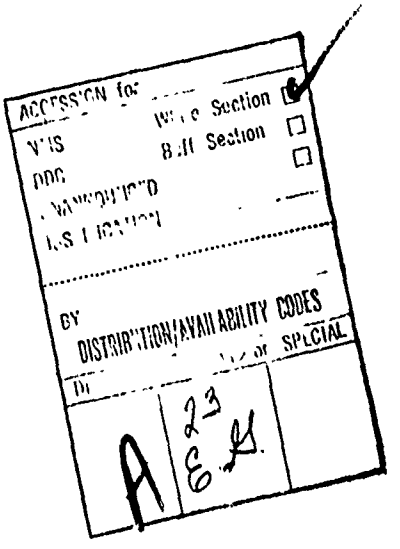
SUMMARY

This report documents the background, approach, and development of a flight safety evaluation methodology for the Navy. This methodology applies a mathematical model in the processing of Navy 3M aircraft equipment failure data to produce a quantified safety index of malfunction-problem severity. The modeling process permits systematic identification of the functional relationships of aircraft equipment to flight safety, and yields safety criticality indices responsive to the probability of occurrence of a malfunction and the probability that it will result in an accident. These indices can then be used in trend analyses to flag potential safety problems.

Increased responsiveness to current operations produced by this model makes the flight-safety methodology unique in its ability to flag events or operations most likely to produce unacceptably high accident risks. Thus the methodology has the ability to currently and continuously rank malfunction problems with respect to their accident potential. This ranking, based on criticality assessment, can provide the basic parameters necessary for analysis of safety versus cost for proposed aircraft modifications, changes in maintenance or flight operations, or even alternative aircraft designs.

The evaluation tool produced in this study will not of itself reduce aircraft malfunction mishaps — only management actions and fiscal expenditures can do so. The utility of the safety assessments available from the application of this tool lies in its ability to alert commanders to the presence of malfunction safety problems and to quantitatively assign an importance to each.



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1
INTRODUCTION

In 1965, ARINC Research Corporation began to explore the desirability and practicability of an objective quantification of flight safety. The investigation, which included a comprehensive review of current flight-safety activities, suggested the feasibility of developing a quantification technique.

An Air Force-funded study by ARINC Research in 1967 demonstrated the feasibility of a predictive technique based on system reliability characteristics. A methodology was developed for providing flight-safety indicators sensitive to changes in equipment malfunction rates, in their effects on the mission, and in unit or fleet operations. This methodology, in conjunction with accident data, permits timely predictions of accident potential, and can contribute to design evaluation and operational planning by providing a degree of safety assessment previously unavailable. The Air Force continued funding of this effort to develop the mathematical models for the F-106 aircraft.

In June 1968 the Naval Safety Center contracted with ARINC Research Corporation to extend this methodology to the F-4J aircraft.

The first months of this effort were devoted to data surveys, collection of flight data, acquisition of aircraft documentation, and formulation of criteria for adapting the Air Force mathematical model to the Navy application. Results of this initial effort appear in the first interim report under this contract.* The report also describes the techniques to be applied in identifying functional relationships and assessing safety sensitivity.

The second interim report,** describes the development of functional diagrams and safety sensitivity assessments for the F-4J aircraft. The functional diagrams and an example of safety sensitivity analyses are presented in the appendices.

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* Development of Flight-Safety Prediction Methodology for U. S. Naval Safety Center, Nov. 1968, Publication 753-01-1-938.

** Development of Flight-Safety Prediction Methodology for U. S. Naval Safety Center, April 1969, Publication 753-01-2-968.

2
STUDY APPROACH

2.1 GENERAL

2.1.1 Present Flight Safety Technology

Probably the most vital, and certainly the most publicized, of flight safety activities is accident investigation. By isolating cause factors, such investigations are instrumental in reducing the probability of recurrence of particular types of accidents.

Traditional safety analysis usually consists of extrapolating historical accident rates into probable future rates. The year-by-year accuracy of such estimates is partly a function of how judiciously the predictor selects and screens his accident rate data. These predictions can be quite accurate when equipment characteristics, maintenance level environments, and pilot skills are consistent with those existing when the accident rates were calculated. Often, however, adverse changes in areas critical to safety are recognized only after the accident rate has been found to be higher than expected and accident investigations have isolated the causes.

Considerable effort has been directed toward improving the predictive technology and "getting a better handle" on the safety status of aircraft. These efforts have resulted in lower accident rates through "pre-accident" identification of safety problem areas; and the associated techniques will continue to be useful for this purpose.

It is being increasingly recognized that safety must be consciously designed into the system, through a disciplined and systematic analysis at every stage of development. Both industry and government are encouraging such design evaluation, as demonstrated by the creation of MIL-S-38130, General Requirements for System Safety Engineering of Systems and Associated Subsystems and Equipment, and the superseding MIL-STD-882 (same title). Both of these documents require system safety analyses for identifying the potential safety effects (including hazards) associated with system malfunctions. The methodology for performing these analyses is often left up to the contractor as long as it is consistent with the requirements and scope of his contract. Unfortunately, an agency using aircraft built by a cross-section of manufacturers will be confronted with a set of system-safety analyses of widely varying approaches and technical quality. The intent of this effort was to create a single methodology that could be used with existing Air Force data systems to provide safety evaluation of operational equipment problems, and applicable to all aircraft in the Air Force inventory.

This methodology will provide otherwise-unavailable information concerning aircraft design, malfunction trends, and the significance of these trends with respect to safety. This information can be used to quantify aircraft operations, equipment, and events in terms of their relative contribution to accidents.

2.1.2 Safety Quantification

The desirability of an objective quantification of safety has long been recognized. However, problems associated with developing a realistic and applicable mathematical technique are formidable, since accidents are statistically infrequent and causes cannot always be determined. The approach must then be to quantify the degree of danger associated with flight operations, since such threats are generally translatable into qualitative terms.

The value of a safety measurement lies in its objectivity and correlation to the "real world." In the popular sense though, the assessment of the safety of any environment or situation is based on both the actual risk and the individual's degree of willingness to accept (or have others accept) that risk. The latter factor is subjective, and results in widely varying assessments of the same event. A quantified safety index reflecting the actual risk will provide the basis for objective assessments, from which the desirability of an activity or operation can be evaluated. In Navy applications, for example, commanders will be able to assess the impact on safety of contemplated changes in equipment and mission profiles.

2.1.3 Flight Safety Concepts

The minimization of personal injury and property damage is the objective of all safety efforts. Safety, when defined as the absence of potential personal injury and property damage, is typically quantified in terms of the total dollar loss resulting from mishaps in operation. From an analysis or predictive standpoint, it is unfortunate that the amount of property damage or personal injury resulting from an aircraft mishap is often determined by conditions external to the functional aircraft system. For example, a malfunction that results in an aircraft hitting a school would be expected to produce far greater diligence in the implementation of remedial action than would be realized if the aircraft were to come down in an unpopulated area.

The dollar-loss quantification parameter is a legitimate and useful after-the-fact performance indicator, but is of little value in assessing the importance of safety problems that have not yet caused dollar loss. Therefore the methodology was designed to produce a measurement scale against which the importance of a problem could be assessed in relation to other problems within the aircraft.

2.2 FLIGHT SAFETY ASSESSMENT TECHNIQUES

In general terms, the assessment techniques rank problem criticalities according to 1) the likelihood that a malfunction will occur, and 2) the resulting degradation to the aircraft's "flyability." The probability of an accident caused by an event can be expressed as the probability of the event times the conditional probability that the event will cause an accident. Stated in equation form,

$$P(\mathcal{A}, E_j) = P(E_j)\,P(\mathcal{A}|E_j)$$

where: $P(\mathcal{A}, E_j)$ is the probability of an accident due to event j;

$P(E_j)$ is the probability of occurrence of event j; and

$P(\mathcal{A}|E_j)$ is the probability of accident given that event j has occurred

In terms of malfunction contributions to accidents, $P(E_j)$ can be thought of as the probability of failure j, and $P(\mathcal{A}|E_j)$ as the probability that the occurrence of failure j will result in an accident.

Since the intent of the efforts described here is to provide a ranking by safety significance of all malfunction problems, it is not necessary that absolute values of $P(\mathcal{A}, E_j)$ be developed. If the values developed are correct relative to each other, a proper ranking will be established.

The assessment techniques developed are based on a factor termed "criticality." Criticality is an index proportional to $P(\mathcal{A}, E_j)$, and which therefore provides the same rank ordering.

The major reasons for the proportionality of the criticality numbers derived by the techniques developed in this study are as follows:

a. The techniques do not include the effect of extraordinary pilot intervention to prevent accident in case of equipment malfunction.

b. Application of the model for quantifying criticality was limited in its treatment of simultaneous occurrence of independent failures.

c. Malfunction and operational data can yield only a proportional estimate of required model inputs.

While strict proportionality cannot be justified, it is believed that the criticality rankings derived through the developed techniques do provide reasonable relative measures of equipment problem potential. The nature of these criticality parameters will be discussed in the descriptions of specific modeling techniques.

This safety criticality assessment methodology could also be applied prior to an aircraft's becoming operational. The assessment of safety criticality during the design phase of aircraft procurement can alert project management to potential trouble areas and functional weaknesses.

2.3 SCOPE OF EFFORT

2.3.1 Specific Approach

As has been stated, the purpose of this effort was to produce a methodology by which safety-related problems can be identified. The methodology establishes the relative influence on flight safety of the various equipments in an aircraft, permitting remedial action to be implemented in a timely and systematic manner.

For this study, an aircraft is assumed to be in a safe condition as long as it is operating within its prescribed performance limits. The measure of safety implied by this approach is a relative measure of how often the aircraft will be in a condition

to cause damage. This definition commits the methodology to the establishment of an objective safety measurement based on what the aircraft can and cannot be expected to do. The definition also has the property of separating quantifiable accident exposure from the complex assessments of damage and personal injury.

The scope of this effort was further limited to that accident exposure caused by aircraft equipment malfunctions. A recent survey of Air Force and Navy accident summaries indicated these cause about 50 percent of military fighter aircraft accidents. Although pilot-related factors are recognized as a significant cause of aircraft mishaps, the Navy and ARINC Research agreed that the successful application of the methodology be limited to aircraft equipment.

This program did not consider ejection capability, parachutes, life rafts, etc., which do not make an aircraft safer, per se, but provide for the survivability of the pilot when the aircraft is unsafe. Collision was also excluded from consideration in the present effort because of the complexity of the interrelationships between pilot, aircraft equipment, ground surveillance, and traffic density, and therefore should be included with subsequent expansion of the methodology.

3
ANALYSIS

Discussed in this section is the development of a capability for assessing problem criticality with respect to flight safety. The following subsections describe the major tasks pursuant to this effort.

3.1 DATA SOURCE SURVEY

A survey of available Navy data was made to determine its adequacy and applicability relative to a flight safety model, and any modifications necessary to the Air Force model to accommodate Navy data.

The Functional Sensitivity Model was specifically developed for use with the 3M data system; however, resolution of the model output with the "real-world" safety picture will be handicapped by certain deficiencies in this system. These deficiencies, with respect to safety analysis, stem basically from the fact that a data system designed for one purpose is to be utilized for another.

3.1.1 Limitations of 3M Data System

The first problem encountered during the functional analysis was the correlation of Work Unit Codes in the WUC manual with the equipment described in the maintenance manual. Compounding this problem is the indenture system used in assigning WUC numbers. Field personnel, when unable to easily find the WUC number, often report the problem at a higher system indenture level to ensure that the piece of equipment in question is covered. This would be a misleading input to the safety model, since from the functional safety sensitivity standpoint, a failure of a particular item of equipment may not result in failure of the system.

The present 3M system has limited provisions for recording when the failure occurred. Out of the 24 "When Discovered" codes available, only two are representative of the type data necessary for processing in the Functional Sensitivity Model. Only the problems identified by When Discovered codes C and D are appropriate for use with this model. When Discovered codes could be easily expanded, using numeric designators, to indicate the phase of flight in which the problem was discovered.

The ability to determine when the problem occurred is necessary not only to apply the appropriate sensitivity value, but should be mandatory in mission success models as well. Analysis of the sample data collected under this contract, which included the mission phase in which failures occurred, revealed that failure rates are not constant throughout the mission but instead generally decrease with flight time.

In the absence of 3M flight-phase recording, an allocation of failures by mission phase must be made (as discussed in Section 4.6.1) to obtain realistic failure probability information.

Another problem area is associated with determining whether a maintenance action was performed as the result of the WUC items ceasing to function, or due to a minor discrepancy in its operation. The majority of the "How Malfunction" codes provided in the WUC manual fail to identify how an item failed. Some identify why it failed, others indicate effects of the failure. This inconsistency keeps "How Mal" information from having any meaningful application to system evaluation models.

The Naval Safety Center's data bank was found to be adequately recording the malfunctions registered by the 3M data system, and the capability already exists within the Center for computing mean time between failure (MTBF) from 3M failure information coupled with flight times reported on pilot debriefing forms (yellow sheets). As in the case of the Air Force math model (designed for application to the AFM 66-1 data system), the "When Discovered" codes used in the 3M system are inadequate for describing the length of time an aircraft is exposed to malfunctions – a basic input to the safety-prediction math model.

An investigation was conducted to determine the impact on the predictive ability of the methodology if only total malfunctions versus total airframe hours were available. Data collected from the Aerospace Defense Command during the earlier Air Force study were examined from this standpoint. It was found that, due to a significant change in failure rate with flight time and mission phase, failure probabilities computed on the basis of a constant failure rate throughout the mission were unrealistic. It was therefore concluded that some form of data screening must be performed in order to provide accurate measurements of malfunction exposure.

3.1.2 Supplemental Data Collection Effort

Due to the magnitude of the effort required to collect all flight-phase information from all naval aircraft, it was decided to initiate an experimental data-collection and analysis program that would provide the data necessary to determine actual malfunction exposure with respect to the total number of failures experienced. The Naval Safety Center arranged for this data collection effort to be conducted at the VF-121 Squadron, Miramar Naval Air Station.

For this effort, ARINC Research compiled a manual for coding pilot-reported malfunction symptoms. The method of symptom coding is unique in its ability to allow machine processing of informal pilot "squawks." This Navy manual was adapted from that used by the Air Force Aerospace Defnese Command in its Interceptor Sortie Evaluation Program, though extended to reflect the F4-B/J aircraft and naval mission requirements. Additionally, ARINC Research developed an experimental pilot debriefing questionnaire (Figure 3-1). These debriefings, held in the Maintenance Control Center following each sortie, provide first-hand (aircrew) information on any malfunction of the aircraft, detailed mission profile information for each flight, and the flight-purpose code.

This data-collection effort was begun in September 1968, and data were compiled from 1000 sorties flown by VF-121. Data received by ARINC Research from the squadron were reduced to computer-punchcard format for analysis of exposure indices. The information was then analyzed to determine the correlation between the number of failures reported and the actual exposure to failure during flight.

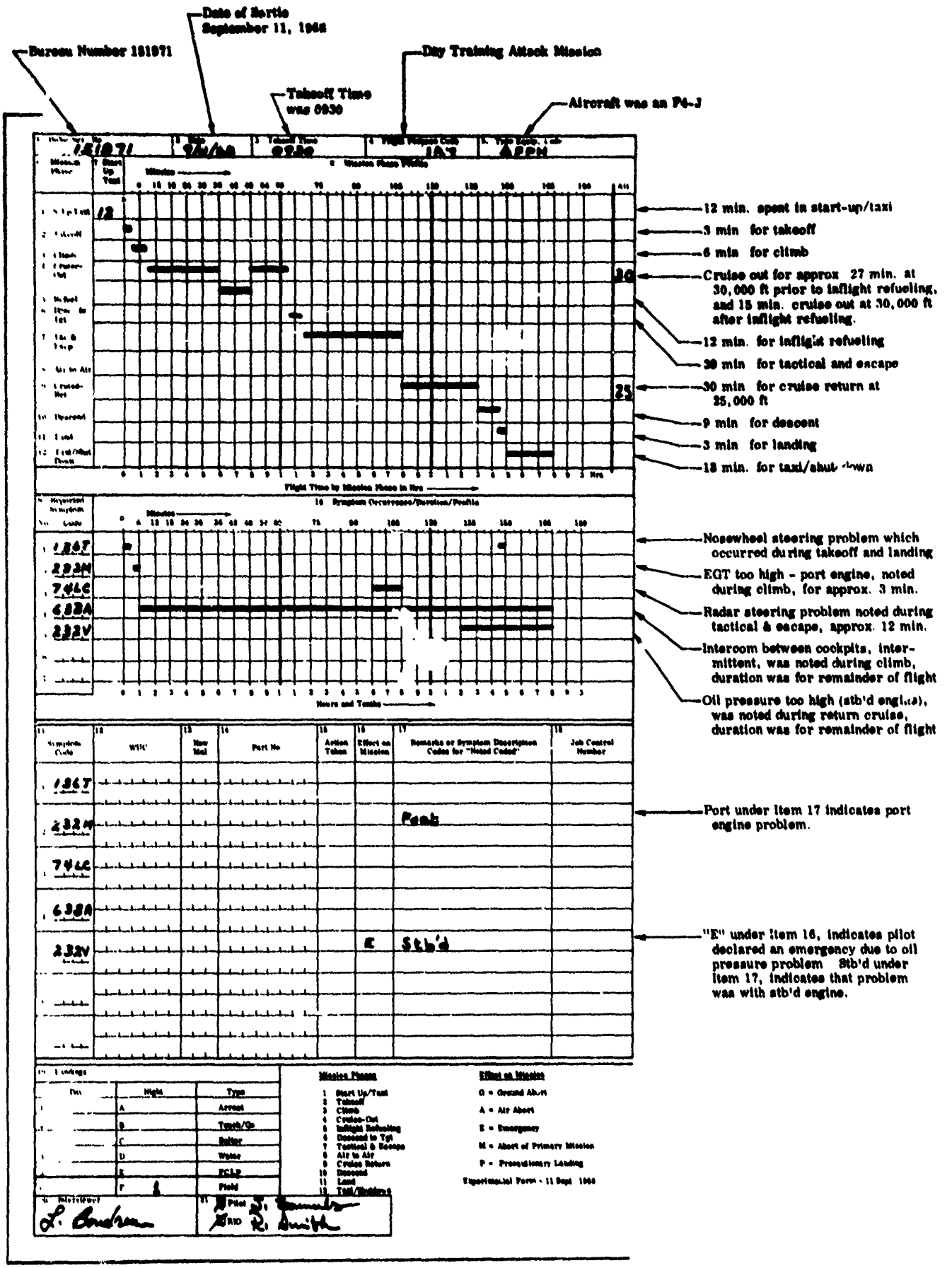

Figure 3-1. Sample Form

The Miramar data were first screened to eliminate CARQUAL and FCLP missions, thereby representing only missions in which mission phases are sequential and nonrepetitive. Naval Safety Center flight-time and 3M data for the Manual Flight Control System were compared with the corresponding VF-121 data and found to agree closely in both average flight time (within two minutes) and failure rate. Because of this good correlation, the method of assessing failure probability by mission phase was established as 1) computing the "average mission" failure probability

$$(P_F = 1 - e^{-\frac{\text{No. failures}}{\text{No. flights}}})^*;$$

and then 2) determining the ratio of aircraft in a failed condition in each flight phase to the total number of flights. The ratio of the percent failed per phase to the mission failure probability was computed for each aircraft system for each mission phase. These values are listed in Table 3-1. In criticality computations utilizing 3M data, these values are used as weighting factors for mission-phase failure allocations. These allocations were used with the applicable safety sensitivity assessment to arrive at the mission phase criticality of malfunctions.

3.2 AIRCRAFT DESIGN DOCUMENTATION

The Naval Safety Center supplied ARINC Research with a complete set of Maintenance and Illustrated Parts Breakdown manuals for the F-4J aircraft. These documents served as the basis for functional analysis and the assessment of safety sensitivity. The adequacy of these documents is comparable to that of the equivalent documents on which the Air Force analysis was based.

A review was made of the documentation available at ARINC Research on the F-4C aircraft, as compiled under the IROS program for the Air Force. Diagrams constructed during this program identify the functional relationships of equipments required for mission success. With respect to a safety sensitivity assessment, however, the objective of the functional analysis must by definition be different; therefore this documentation was primarily of value in identifying Work Unit Codes for various aircraft equipments.

Due to the differences in the Navy/Air Force versions of the F-4, and the difference in the purpose of the two safety efforts, the functional analysis under the Navy contract did not utilize the Air Force F-4C documents. They were used only as a reference in cases where questions arose as to how the aircraft operates.

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*This equation reflects the application of the traditional reliability equation, $R = e^{-\lambda t}$, modified to apply to only the average mission time($\frac{\text{Total Time}}{\text{No. of Flights}}$). Because λ is equal to the number of equipment failures divided by the total flight time, the exponent becomes equal to the number of failures divided by the number of flights.

TABLE 3-1. PROBABILITY OF BEING FAILED IN EACH MISSION PHASE, BASED ON DATA COLLECTED FROM VF-121 FLIGHTS AT MIRAMAR NAVAL AIR STATION

Aircraft System	Probability of Being Failed in Indicated Mission Phase								
	1	2	3	4	5	6	7	8	9
Airframe	0.2784	0.3408	0.3274	0.2499	0.6102	0.4529	0.4577	0.5335	0.6330
Fuselage Compartment	0.4053	0.7249	0.7251	0.5028	0.6825	0.5026	0.7664	0.8654	0.8929
Landing Gear	0.0503	0.4027	0.2514	0.1509	0.1506	0.1510	0.2019	0.6026	0.8582
Flight Control, Manual	0.3936	0.4709	0.5087	0.4326	0.4749	0.4674	0.6732	0.5911	0.7902
Flight Control Augmentation	0.2755	0.6413	0.7310	0.3692	0.8303	0.5558	0.7405	0.8296	0.8288
Engine	0.4694	0.6084	0.4392	0.3363	0.3711	0.6417	0.4396	0.4707	0.5410
Air Condit./Pressurization	0.3309	0.4119	0.4128	0.2903	0.6196	0.3710	0.4139	0.4931	0.5789
Electrical Power	0.1603	0.3739	0.4280	0.2404	0.1855	0.0791	0.5311	0.2937	0.2665
Lighting System	0.3615	0.4213	0.5415	0.4231	0.5410	0.5429	0.6636	0.6605	0.8450
Hydraulic/Pneumatic	0.5000	0.1998	0.2999	0.2999	0.1005	0.4005	0.4011	0.4999	0.9008
Fuel	0.4126	0.4522	0.4941	0.4951	0.3302	0.3300	0.4954	0.5371	0.7009
Instruments and Indicators	0.4767	0.6691	0.6900	0.4932	0.7077	0.4818	0.7942	0.8654	0.8795
Computer (CADC)	0.5000	0.7992	0.9005	0.8008	0.6039	0.5004	1.0000	0.9988	0.9968
Autopilot Assist	0.3353	0.4492	0.6748	0.4500	0.3365	0.1121	0.6732	0.6726	0.5597
UHF	0.4126	0.6010	0.6958	0.5673	0.7642	0.6184	0.8818	0.9058	0.4461
IFF	0.8106	0.8055	0.8110	0.6326	0.6290	0.5393	0.9020	0.8968	0.8982
TACAN	0.3936	0.5824	0.5848	0.4903	0.7171	0.6344	0.8521	0.8296	0.8308
ADF	0.4490	0.8085	0.8070	0.7212	0.5347	0.8053	0.9020	0.8968	0.3929
Navigation Computer	0.8893	0.7435	0.7455	0.5961	0.4403	0.4494	0.7405	0.7488	0.7462

4
FUNCTIONAL SENSITIVITY MODEL

4.1 GENERAL

Equipment criticalities can be assessed by means of the activities indicated in Figure 4-1. The first activity, Functional Analysis, is the identification of all functions the aircraft is expected to perform and the determination of their interrelationships. Safety Dependency Analysis determines which of these aircraft functions are necessary for flight safety. In Safety Sensitivity Assessment, an estimate is assigned to each function of the probability of accident occurrence in the event that function is lost. These conditional probabilities are termed "functional sensitivities," and when applied as weighting factors for the malfunction occurrence rates represented on the second line of Figure 4-1, provide the basis for an assessment of accident potential and, correspondingly, of equipment criticalities. Data on aircraft operation and accident causes can be used to modify the sensitivity estimates, thereby improving accident potential and equipment-criticality assessments. The development of this technique was the major aspect of the present program.

4.2 MODEL DESCRIPTION

The Functional Sensitivity Model is based on a detailed functional analysis of the system, and is responsive to Work Unit Code malfunction information such as provided by the 3M data system and demonstration of its compatibility with and application to actual 3M failure data.

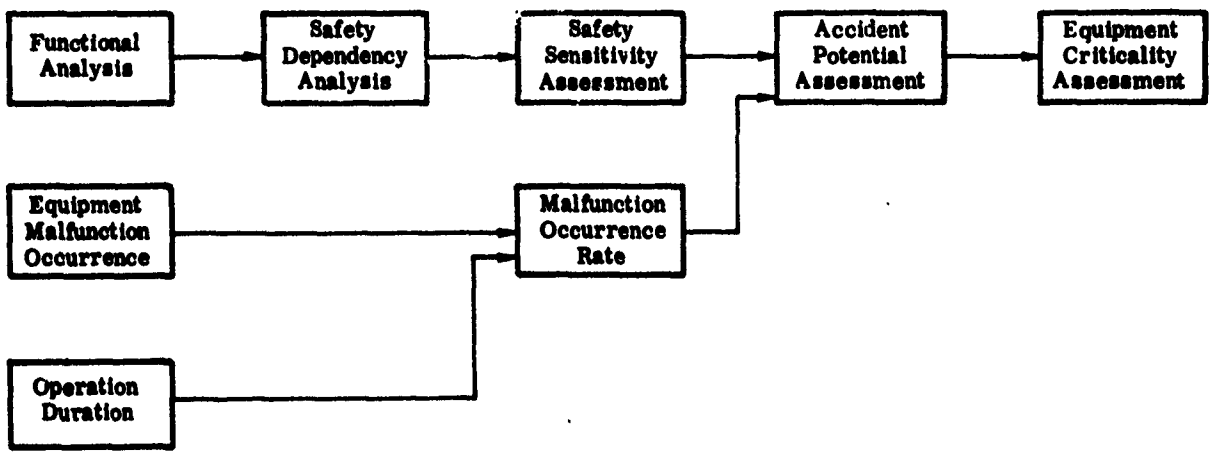


Figure 4-1. Safety Assessment and Measurement Flow Diagram (Functional Sensitivity)

4.2.1 A Simplified Accident Probability Model

4.2.1.1 Basic Equations

To provide an overview of how the Functional Sensitivity Model relates to accident probability, we shall consider the following simplified version of an accident probability model. Let

> β_j represent system operational state j, consisting of a particular combination or states of individual elements within the system (the simplest type of such combination would be one for which each element can be classified as being either a success or failure).
>
> $P(\beta_j)$ represent the probability that the j^{th} state occurs during the mission.*
>
> $P(\mathcal{A}|\beta_j)$ represent the probability of an accident, given that state j occurs.

The overall probability of an accident, $P(\mathcal{A})$, is then given by the equation

$$P(\mathcal{A}) = \sum_j P(\beta_j) P(\mathcal{A}|\beta_j) \tag{1}$$

This model is of course overly simplified, but even in this form it represents a formidable quantification task. The number of states to consider is of the order 2^N, where N is the number of individual elements in the aircraft. When mission phase-sequencing, interdependency of failures, and element degradation states (other than success or failure) are considered, the necessary modeling and quantification procedures become prohibitive. To develop a workable model, therefore, it was necessary to consider system states involving only dependent failures.** That is,

$$P(\mathcal{A}) = \sum_j P(\mathcal{A}, j) \tag{2}$$

where: $P(\mathcal{A}, j)$ = the probability of an accident due to failure of just the j^{th} element.

Since

$$P(\mathcal{A}, j) = P(j) P(\mathcal{A}|j) \tag{3}$$

where: $P(j)$ = the probability that element j fails

$P(\mathcal{A}|j)$ = the probability of an accident given that the j^{th} element fails.

Then

$$P(\mathcal{A}) = \sum_j P(j) P(\mathcal{A}|j) \tag{4}$$

---

*For exposition purposes, the sequencing of state occurrences and element states leading to the j^{th} state are ignored.

**An exception was redundant designs, for which multiple-failure cases were considered (see Section 4-4).

Basic terms in the foregoing equations are assigned the following nomenclature:

$P(\mathcal{A}, j)$ is termed the criticality of the j^{th} element; for convenience of discussion, this parameter will be represented by C_j;

$P(\mathcal{A}|j)$ is termed the sensitivity of the j^{th} element, and will be written as S_j.

$P(j)$ is termed the function loss probability of the j^{th} element, and will be written as P_j.

Thus, by this nomenclature, equation 3 can be written,

$$C_j = S_j P_j \tag{3a}$$

4.2.1.2 Flight Phase

Because an element's effect on safety may depend on the portion of the flight during which a malfunction exists, it was necessary to extend the Functional Sensitivity Model to permit accounting for this effect.

Consider an aircraft for which a standard mission of K phases is prescribed. If we denote by $S_{j,k}$ the accident sensitivity of element j in the k^{th} phase; that is,

$S_{j,k}$ = P(accident in phase k given element j is failed in that phase),

then the overall criticality of the j^{th} element can be expressed as

$$C_j = \sum_{k=1}^{K} P_{j,k} S_{j,k} \tag{5}$$

where: $P_{j,k}$ = probability that element j is failed in the k^{th} phase.

$P_{j,k}$ is a complex function of phase-dependent, first-failure probabilities, phase-transition probabilities, and previous sensitivity values. The model for $P_{j,k}$ is discussed in Appendix E.

4.2.2 Use and Limitations of the Model

One basic limitation of the model is that criticality rankings apply only to individual elements, relative to each other. Element-failure combinations are, for the most part, not considered. Failure of a particular element, say j_1, may not be critical if each of a particular set of other elements are satisfactory. However, if one or more of these other elements are failed, failure of j_1 may be quite critical. Multiple failures are considered only when there is a "first-order" functional dependence.

This imposed limitation of the model is primarily one of avoiding undue complexity for the initial development. The basic approach used could allow for independent joint failures, but such inclusion would have effectively increased from N to $N^2/2$ the number of system states to consider, where N numbers in the thousands.

4.3 SCOPE OF PRESENT EFFORT

The basic objective of this program is the development of a model for element criticality based on element sensitivity and malfunction probability.

At the outset of this program, it was anticipated that the existing Air Force flight safety model could be adapted in a limited-utility format for routinely processing Navy data to arrive at flight safety measurements. The initial idea was to use the total number of failures and the total flying hours to arrive at an average MTBF, and from this to compute the probability of failure. The latter quantity, together with the sensitivity estimate, would then provide a meaningful malfunction exposure and/or accident exposure index. Upon investigation, however, the available information was found to be inadequate and inaccurate. Recognizing this factor, the Naval Safety Center agreed that, rather than have an early model with these properties, it would be far more desirable to embark upon an investigation to determine how best to arrive at an accurate model.

The first step in the subsequent activity was the initiation of a sample data collection program at Miramar Naval Air Station. This effort resulted in obtaining actual equipment malfunction exposure measurements from which the basic factors affecting malfunction occurrence could be examined.

Assuming the validity of the basic expression, $C_j = S_j \cdot P_j$, the development of criticality rankings for the various elements (j's) of a system is dependent upon the ability to quantify the malfunction probability (P_j) and element sensitivity (S_j) for each element. The first requirement, that of determining malfunction probabilities, depends on the use of 3M data, as discussed in Section 2. Establishing element sensitivities represents the second requirement, and is discussed in the next section.

4.4 MODEL DEVELOPMENT

4.4.1 General

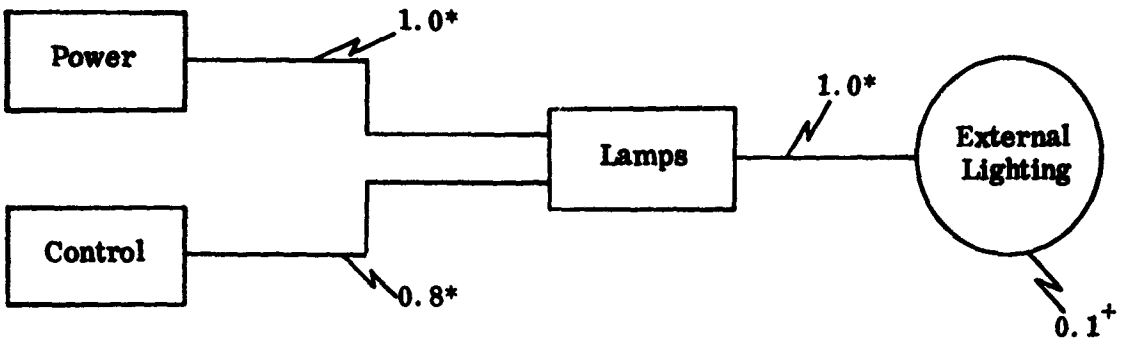
To implement the basic safety model, it is necessary to develop a submodel for $S_{j,k}$, the probability that a malfunction in element j during mission phase k will result in an accident. This submodel in turn requires that we estimate two parameters: the probability of accident if a major function is not available during each mission phase; and the dependence of the major function on element j during each mission phase.

The first parameter is termed "functional sensitivity" and is estimated for each major function. The functional analysis performed in this task (see Section 4.5.1) established for the F-4J aircraft the following hierarchical scheme:

Aircraft
Primary functions
Major functions
Function
Elements (Work Unit Codes)

A primary function would be one such as Flight Control. Major functions under Flight Control would include Pitch Control and Yaw Control.

The second parameter, "link dependency," is a vehicle for showing the influence of each functional-path element on the performance of a major function. For example, if the major function being considered is External Lighting, the diagram on the following page illustrates possible functional sensitivity and link dependency values.



*Link dependencies
+Functional sensitivity

The 0.8 value means that failure of the Control function will result in loss of the Lamp function 80% of the time. The 0.1 functional sensitivity value denotes that loss of external lighting will result in an accident 10% of the time. The values must be interpreted in a proportional sense, in that the actual accident probability is dependent upon external factors, as discussed previously.

The remainder of this section discusses the procedures and model used to obtain element sensitivities; e.g., in the above example, the accident probability given that a Work Unit Code in the Control function malfunctions.

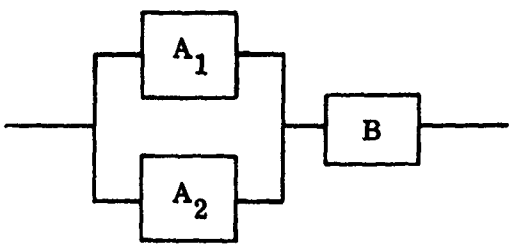
4.4.2 Definition of Principal Functional Relationships

Three principal types of functional relationship--series, redundant, and parallel--were identified as representing the major forms to consider in modeling element sensitivity.

Series Relationship – A function having only one input. Schematically,

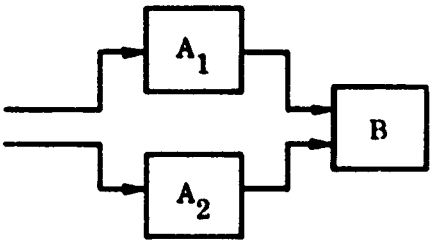
which indicates that outside of its own elements, the success of B is only affected by the success of A.

Functional Redundancy – A function having one or more backup functions that can provide the required inputs to successor functions. Schematically,



where A_1 and A_2 represent a functional redundancy in that either may provide the necessary input to B.

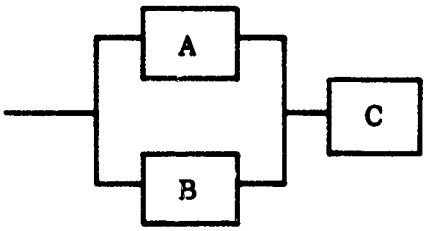
Parallel Functions — Two or more functions independent of each other in terms of functional success, but each of which may be required for a successor function. Schematically,



B will generally require both A_1 and A_2; but A_1 does not depend on A_2, nor does A_2 depend on A_1.

In some cases the distinction between functional redundancy and parallel paths is very slight, and may depend on mission phase. For example the four engines of a plane can be considered to be a redundant configuration providing inputs to the primary propulsion function during cruising, but would generally be considered to be parallel functions during takeoffs requiring full power.

In general, given a schematic relationship of the form,



we can say that A and B are in a functionally redundant configuration if the success probability of C is the same if 1) A and B are successful, 2) A only is successful, or 3) B only is successful. If, for example, C is more likely to be successful if both A and B are successful, rather than A or B alone, then the relationship is one of parallel paths.

It is noted that the model will also account for element redundance and parallel elements through inputs such as $P(\overline{A}|i_a)$, representing the probability that the Ath function fails given that the i_a^{th} element in A has failed. If i_a is a parallel element, the probability would depend on mission requirements and other parallel-element states.

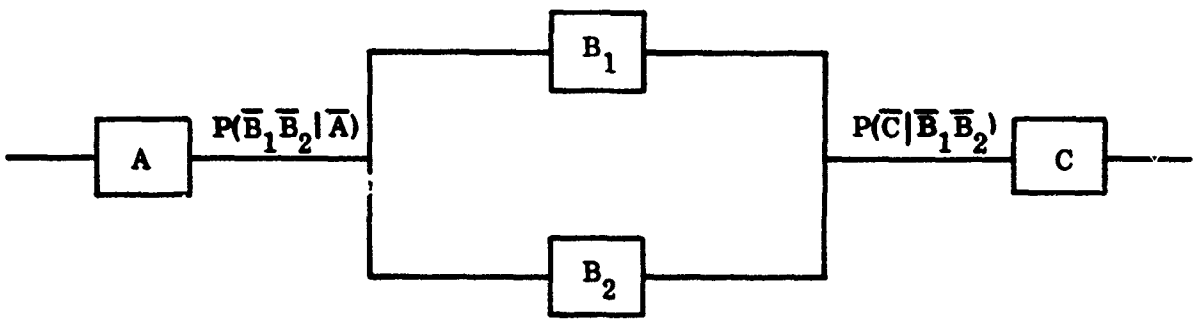
4.4.3 Link Dependency

Link dependency is the conditional probability of a functional failure, given the failure of immediate predecessor functions. The link dependencies applicable to the three basic designs defined above are shown below.

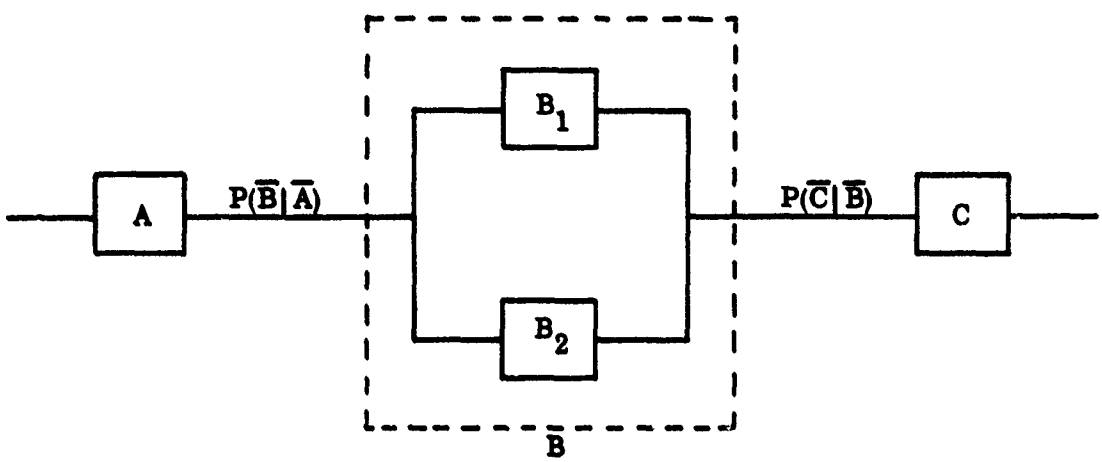
Series Relationship

Link dependency = $P(\overline{B}|\overline{A})$ = probability that B fails given that A fails.

Functional Redundancy

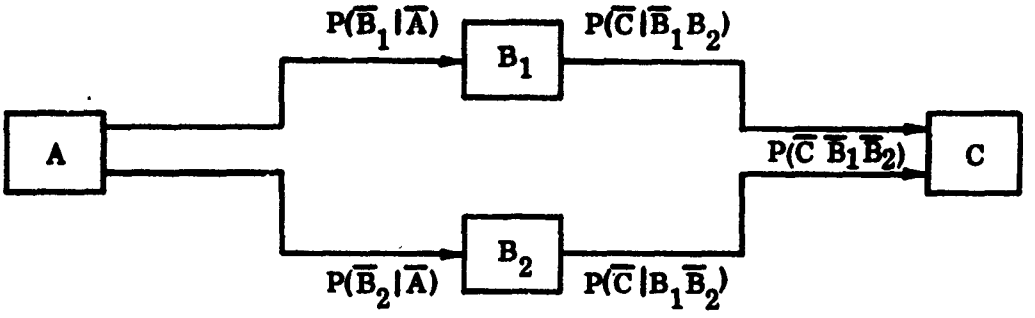


equivalent to



where $\overline{B} = \overline{B}_1\overline{B}_2$

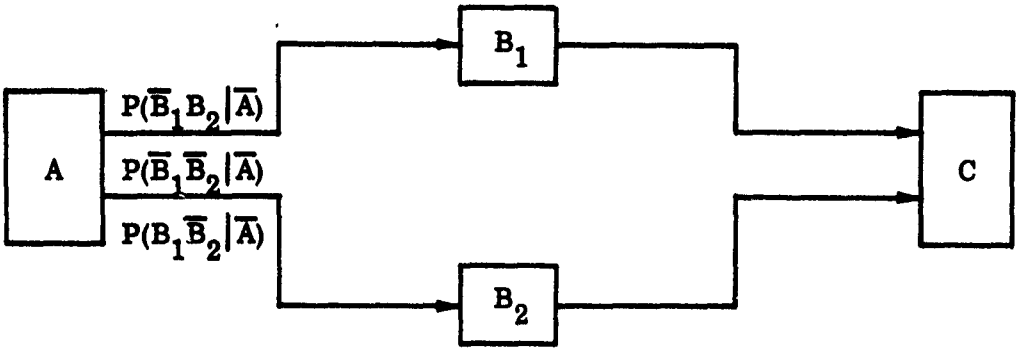
Parallel Functions



We shall generally assume that the dependencies of B_1 with respect to A, and of B_2 with respect to A, are independent of each other, so that

$$P(\overline{B}_1\overline{B}_2|\overline{A}) = P(\overline{B}_1|\overline{A})P(\overline{B}_2|\overline{A})$$

We then can consider three link dependencies from A to B as follows:



noting that

$$P(\overline{B}_1|\overline{A}) = P(\overline{B}_1 B_2|\overline{A}) + P(\overline{B}_1\overline{B}_2|\overline{A})$$

$$P(\overline{B}_2|\overline{A}) = P(B_1\overline{B}_2|\overline{A}) + P(\overline{B}_1\overline{B}_2|\overline{A})$$

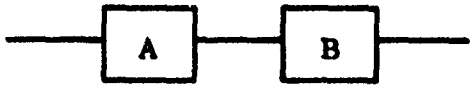
4.4.4 Models for Element Sensitivity

Models are shown below for determining the sensitivity of elements for each of the three basic designs. The derivation of each model is detailed in Appendix C. The following basic assumptions apply:

a. Except for cases when an element has a redundant or parallel counterpart or is located in a function with a redundant or parallel function, only the element under consideration shall be assumed to have failed initially. Thus the

expression $P(\mathcal{A}|i_a)$, representing the accident probability given failure of the i^{th} Work Unit Code element, is based on the assumption that no other element has failed unless element i is in some redundant or parallel configuration. For cases in which there are redundant or parallel counterparts, failures of such counterpart elements or functions are considered in accordance with their occurrence probabilities.

b. The success of all immediate predecessors ensures the success of a function, provided that the function experiences no element failures Thus for the series relationship



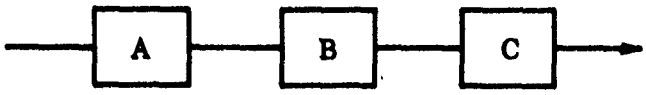
we assume

$$P(\overline{B}|A) = 0,$$

provided B experiences no element failures. If an element in function A is under consideration, the latter provision is always true by assumption "a."

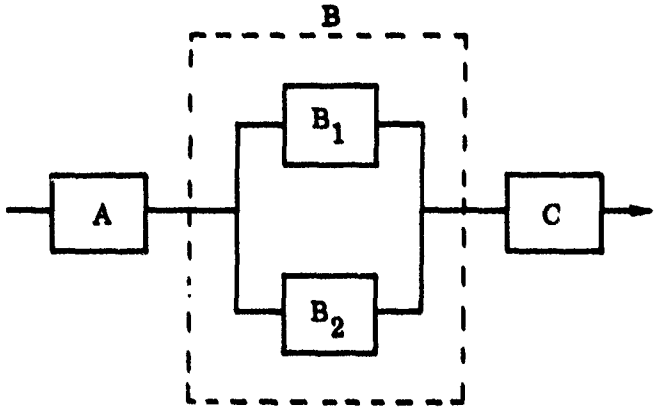
The element sensitivity models are:

Series Relationship



$$P(\mathcal{A}|i_a) = P(\overline{A}|i_a)P(\overline{B}|\overline{A})P(\overline{C}|\overline{B})P(\mathcal{A}|\overline{C})$$

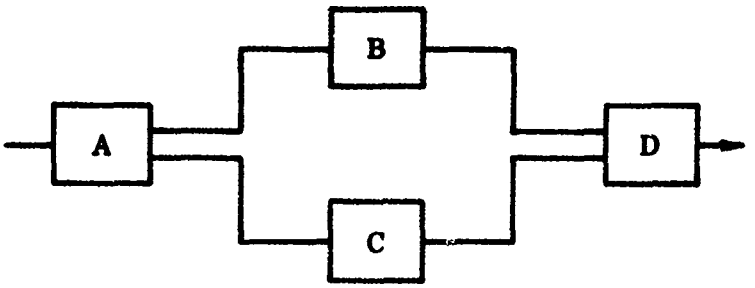
Functional Redundancy



$$P(\mathcal{A}|i_a) = P(\overline{A}|i_a)P(\overline{B}|\overline{A})P(\overline{C}|\overline{B})P(\mathcal{A}|\overline{C})$$

$$P(\mathcal{A}|i_{b1}) = P(\overline{B}_1|i_{b1})P(\overline{B}_2)P(\overline{C}|\overline{B})P(\mathcal{A}|\overline{C})$$

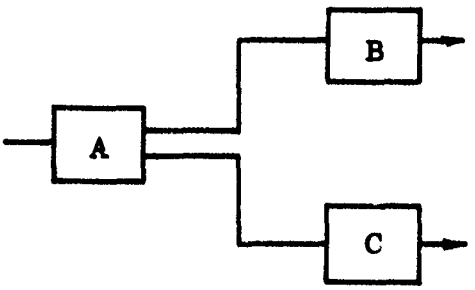
Parallel Functions



$$P(\mathcal{A}|i_a) = P(\overline{A}|i_a)\{P(\overline{B}C|\overline{A})P(\overline{D}|\overline{B}C) + P(B\overline{C}|\overline{A})P(\overline{D}|B\overline{C}) + P(\overline{B}\overline{C}|\overline{A})P(\overline{D}|\overline{B}\overline{C})\}P(\mathcal{A}|\overline{D})$$

$$P(\mathcal{A}|i_b) = P(\overline{B}|i_b)\{P(\overline{C}|i_b)P(\overline{D}|\overline{B}C) + P(C|i_b)P(\overline{D}|\overline{B}C)\}P(\mathcal{A}|\overline{D})$$

A case not explicitly included in the above three basic functional relationships is one for which a function is in two paths, e.g.,



then

$$P(\mathcal{A}|i_a) = P(\overline{C}|i_a)P(B|i_a)P(\mathcal{A}|\overline{C}B) + P(C|i_a)P(\overline{B}|i_a)P(\mathcal{A}|C\overline{B}) + P(\overline{C}|i_a)P(\overline{B}|i_a)\{1 - P(\overline{\mathcal{A}}|\overline{C})P(\overline{\mathcal{A}}|\overline{B})\}$$

where it is assumed that the effects of loss of the major functions in accident occurrence are independent of each other.

4.5 MODEL IMPLEMENTATION

The principal tasks involved in employing the Functional Criticality Model involve:

a. Performing functional analysis

b. Estimating major-function sensitivities

c. Estimating link dependencies

d. Developing a computer program for model implementation.

These tasks will be discussed in the following sections.

4.5.1 Functional Analysis

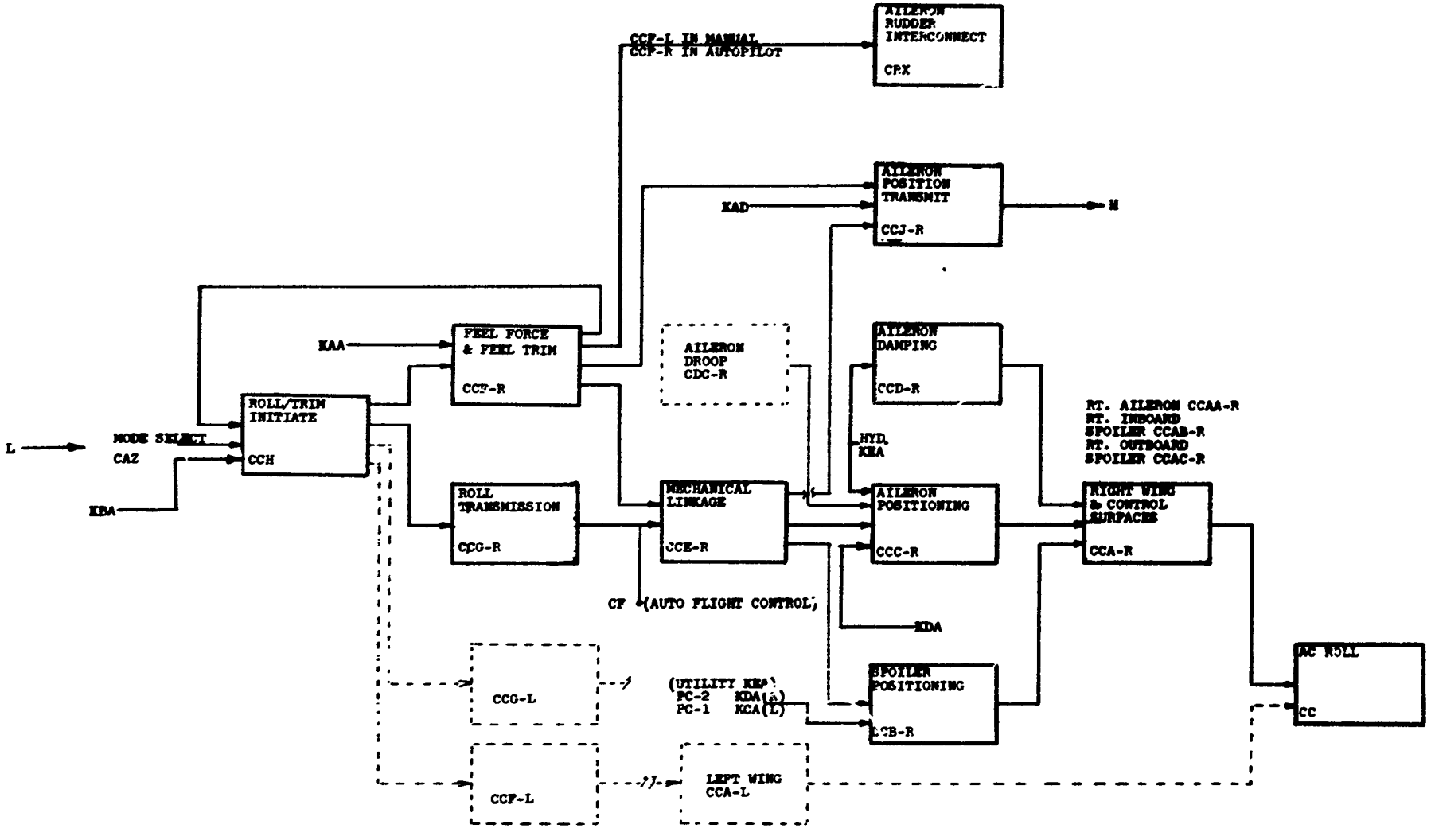
The first task in assessing element safety sensitivity is the identification of the functions performed by the aircraft and how they are interrelated. This functional analysis was performed with information in NAVAIR maintenance manuals used in the preparation of working-draft functional diagrams. Tabulated for each identified aircraft function were 1) the equipment necessary for its performance; 2) equipment operating modes; and 3) all inputs required from other systems. The functional analysis then entailed the systematic documentation of relationships of equipment to the function performed.

The sample sensitivity assessment conducted during Phase II-A demonstrated the extreme care required in producing an accurate analysis. The complexity of the functional interdependencies in an aircraft such as the F-4J required the development of a systematic accounting procedure to ensure against losing functional paths and assuring that all relationships had been accounted for. All functional relationships identified in the working-draft functional diagrams were recorded in a coded format, from which a punchcard was created for each relationship.

For computer locating purposes, each function of the aircraft carries an indentured "alpha" code indicating the primary safety sensitivity path. The diagram of Figure 4-2, for example, identifies the Aircraft Roll function as CC, which requires inputs from CCA-R and CCA-L, the right and left wing control surfaces, respectively. These elements are further indentured until all WUC items are accounted for by alpha designator. Each item of equipment receives an alpha designator and therefore the number of alpha designators identified with a particular WUC equals the number of items installed in the aircraft having the same WUC.

The basic scheme used was hierarchical in the sense that a "predecessor" function provides an input to one or more "successor" functions. Thus the success of a function as defined by this scheme is dependent (wholly or partially) on correct inputs from one or more predecessor functions. For example the function Landing Gear Extension depends on the subfunctions Left Main Landing Gear Extension and Nose Landing Gear Extension. Nose Landing Gear Extension, in turn, is dependent upon Nose Landing Gear Door Openings and Nose Gear Activation.

Because of the complexity of aircraft systems and the interdependency of one system on another, no consistent universal indenture system (from function to subfunction, etc.) is possible. One example of the problem, as can be seen in several of the diagrams in Appendix A, is the formation of functional loops. If all the diagrams applicable to an aircraft were combined, the total diagram would be so tangled with these loops that no meaningful analysis could be made. Accordingly, ARINC Research elected to follow the proc3dure of subdividing the aircraft into the nine primary and two support functions, identifying the input requirements for each and recording each functional relationship in a punchcard format. This procedure was followed down to the WUC level. A computer program was designed that could identify and document each functional path.



Aircraft: F-4J	
Title: Functional Diagram LATERAL CONTROL SYSTEM	
Document: NAVAIR 01-245FDB-2 2.2	**rev. date** 15 Apr 1968
Date: 23 Apr 1969	

Revised 20 May 1969

Figure 4-2

Performing the path identification/documentation task by computer proved to be not only useful but necessary. The human analyst could neither keep track of all functional paths nor assign a numerical sensitivity to each path. The machine processing allows the human analyst to consider only one functional link at a time. The ability to be able to follow all of the functional interrelationships within the aircraft was necessary for meaningful assessment of safety.

Appendix A to this report contains the functional relationship diagrams applicable to the F-4J aircraft. Most of these diagrams have been revised since the publication of the second interim report (ARINC Research Publication 753-01-2-968) in April 1969. Revisions were necessary to reflect more clearly and accurately the interrelationships of the functions.

Following each section of functional diagrams in the appendix is a listing of the functional and WUC relationship cards for that section. This listing identifies the equipment required to accomplish each subfunction, and the functions required to accomplish the next higher level function. The functional-link safety sensitivities are included in the individual cards and in the format of the printout.

4.5.2 Major-Function Sensitivity Assignment

The sensitivity of a function is defined as the probability that failure of the function will cause an accident. From the functional analysis, major functions were identified for the F-4J aircraft. This task consisted of assigning sensitivities to each of these major functions for each phase of the mission.

As discussed previously, the actual numerical values assigned were proportional rather than absolute. The assignments were made by a team of safety engineers, and were based on the general assumption that major-function failures are mutually independent with respect to aircraft accident probability.

The significance of certain major functions is dependent on external influences, for which cases "Provisory Factors" were identified. An example would be a windshield anti-ice system, which has a sensitivity close to 1.0 during landing under icing conditions but has no effect on safety on a dry, warm day. For such major functions, the procedure used was to always assign a "worst case" sensitivity which would then be modified in the computerized procedure by application of an assigned Provisory Factor. In general, Provisory Factors represent the probability of the existence of external conditions influencing the sensitivity of the function.

Table 4-1 lists provisory conditions considered in analyzing the F-4J aircraft.

TABLE 4-1. PROVISORY FACTORS USED IN SAFETY SENSITIVITY ASSESSMENT OF F-4J AIRCRAFT

Code	Provisory or Conditional Factors
A	Ice
D	Night
E	IFR
F	Supersonic
G	Rain
K	Normal system failed
N	Drag chute failed
P	Carrier takeoff
Q	Carrier landing
S	Wheel brakes failed

4.5.3 Link Dependency Assignment

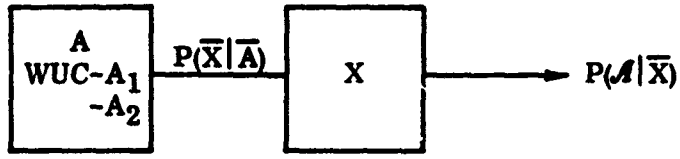
The link dependency between two functions A and B, where B is dependent on A, is defined as the probability that the loss of function A will result in the loss of the function B.

The specific functions were defined by functional diagrams showing the relationships between them (i.e., series, parallel, or redundant), to higher-level functions. Also, the individual hardware items identified by Work Unit Codes that make up a function were determined in the functional analysis task.

Link dependencies for major functions were assigned by a team of safety engineers. These values are also mission-phase dependent in that a function's importance to a successor function may depend on the mission phase. The basis of such assignment for the more common cases is discussed below.

4.5.3.1 Simple Series Relationship

Consider the case in which X is a major function and A a predecessor function:

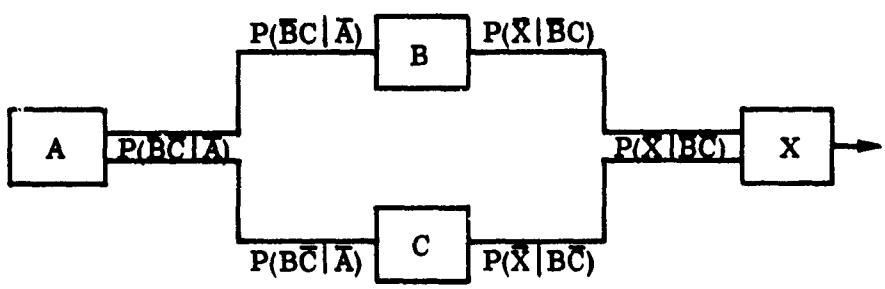


The major function sensitivity value is $P(\mathcal{M}|\overline{X})$ and the link dependency A-to-X is $P(\overline{X}|\overline{A})$. If A is required for X, the link dependency is 1.0, independently of the sensitivity of X. For example, X may have a sensitivity of zero when on the ground (Phases 1 and 9) and a sensitivity of 1.0 when in flight (Phases 2 - 8)*. However, $P(\overline{X}|\overline{A})$ would still be assigned a value of 1.0 for each phase if X cannot perform successfully without an input from A.

Link dependency values of the Work Unit Code to the function, e.g., A_1 to A, are also required. If, for example, WUC-A_2 in the above diagram serves the purpose of damping out certain oscillations that create an inconvenience but little hazard to the successful accomplishment of the function, the link dependency $P(\overline{A}|\overline{A}_2)$ would be assigned a low value.

4.5.3.2 Parallel Functions

The basic parallel-function relationship is shown in the diagram below.

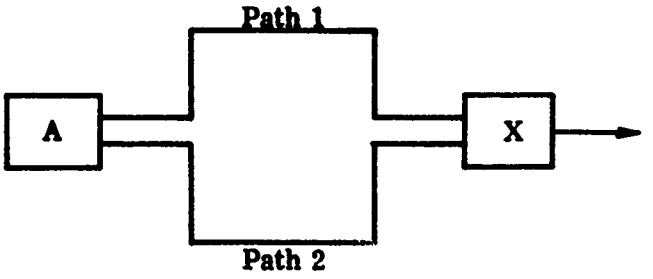


*Numbering of flight phases was done as follows:

1. Startup and taxi	4. Cruise out	7. Descend
2. Takeoff	5. Maneuvering	8. Land
3. Climb	6. Cruise return	9. Taxi and shutdown

The six pertinent link dependency values are shown on the appropriate path legs. For the predecessor functions to X (B and C), three link dependency values are required, reflecting failure of either 1) just B, 2) just C, or 3) both B and C. It is noted, however, than in evaluating the sensitivity of function B, for example, it is assumed in the application of the sensitivity model that function C is present, so that the sensitivity of B would be $P(\overline{X}|\overline{BC})P(\mathcal{A}|\overline{X})$, if X is a major function.

The joint failure link dependency value, $P(\overline{X}|\overline{BC})$, is only used in evaluating the sensitivity of function A, for failure of A can lead to failure of both B and C. The relationship of A to X, being of the general form,



has been termed "divergent-convergent."

In every case where such relationships existed in the aircraft, it has been determined that paths 1 and 2 would fail if A was lost. In effect, this means that the following link dependency relationships hold, using the previous diagram.

$$P(\overline{BC}|\overline{A}) = 0$$
$$P(B\overline{C}|\overline{A}) = 0$$
$$P(\overline{BC}|\overline{A}) = 1.0$$

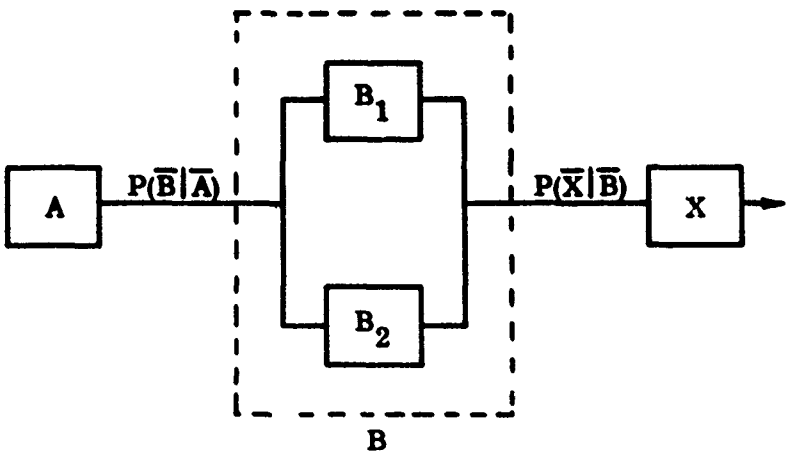
This inherent characteristic concerning link dependencies in the divergent-convergent cases is primarily due to the manner in which the functions in the aircraft were defined.

For implementing the computerized form of the sensitivity model, three data input cards would have to be provided for A: one showing X as the dependent function for sensitivity computation, and two others indicating B and C as dependent functions for functional path tracing and not for sensitivity calculation.

Again, link dependency values for Work Unit Codes within each function are also assigned.

4.5.3.3 Redundant Functions

The basic redundant-design relationship is illustrated below:



where $\overline{B} = \overline{B}_1\overline{B}_2$.

Function B_1 is assumed to be the primary or normal mode of operation, with B_2 as the emergency or backup mode. The dependency $P(\overline{X}|\overline{B})$ indicates the importance of the B function to X and is necessary for assessing the sensitivity of A, B_1, and B_2. In all cases this dependency was assigned a value of 1.0.

In considering the normal mode of operation, the possibility of failure of the backup mode is included in the sensitivity model by the term $P(B_2)$; see Section 4.4.4. In the absence of failure information on backup modes of operation, it was assumed that the backup mode would be available 50 percent of the time when the normal mode failed. The data card input identifying the relationship of B_1 to X would identify B_2 as the alternate mode.

In the case of B_2, it was assumed that this backup mode could, if present, perform the function with the normal mode inoperative; i.e., $P(\overline{X}|\overline{B}_1B_2) = 0$.

In the computerized procedure, the link dependency of B_2 is assigned a value of 1.0, which is equivalent to assuming that B_1 is failed. The conditional sensitivity of B_2 is then calculated on this basis. The computer output, however, indicates that B_2 is a backup to the primary function B_1. Therefore the conditional sensitivity of B_2 must be multiplied by the malfunction probability of B_1 to obtain the unconditional sensitivity.

4.5.4 Computer Program for Sensitivity Assessment

The computerized procedure for sensitivity assessment requires the following data inputs:

a. Functional and Work Unit Code relationships

b. Major function sensitivities

c. Link dependencies

d. Provisory factor conditions.

A computer program was developed which operates on these inputs in accordance with the basic sensitivity models to yield sensitivity estimates of individual Work Unit Codes and functions by mission phase. Where provisory factors or backup modes of operation are involved, the computer output indicates that the sensitivity values produced by the computer are conditional, and must be adjusted to reflect the provisory condition probability or failure probability of the primary redundant function.

The three major phases of the program are discussed briefly below, and in greater detail in Appendix B.

4.5.4.1 Path Generator Phase

In this phase, all functional paths are traced and documented from the information presented in the input data cards, and WUC (element) sensitivities are then computed by phase for each path in which the WUC exists. The resulting computer printout would be too bulky to include in this report. Figure 4-2 is a reproduction of a typical printout page.

4.5.4.2 Sort Program Phase

Results of the Path Generator Phase are sorted by WUC, alpha designator, and provisory factor. The information is stored on tape for use in the Path Combining Phase discussed below.

4.5.4.3 Path Combination Phase

Generated in this phase is the overall sensitivity for each WUC, taking into consideration the dependence of more than one major function on a WUC. In a system as complex as the F-4, it is common for a function to have several dependent higher-level functions. Because of the basic assumption of independence of major function sensitivity values, the sensitivity of a WUC involved in N major functional paths is determined by the relationship:

$$S_T = 1 - (1-S_1)(1-S_2)\cdots(1-S_N)$$

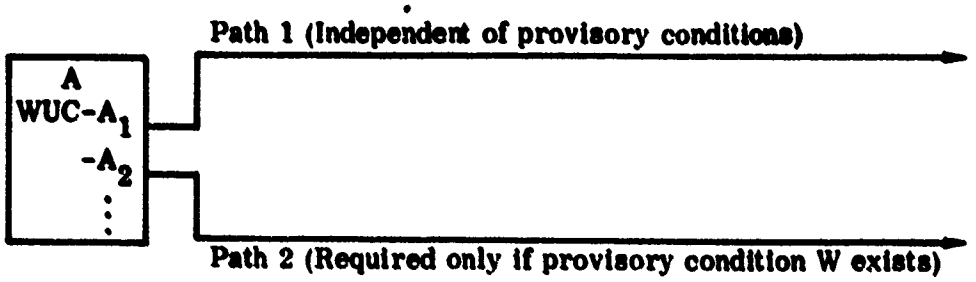
where

S_T = total sensitivity of the WUC;

S_i = sensitivity of the WUC in the i^{th} path.

Another condition handled by this phase of the program is the case where several identical hardware items are used in the aircraft. Each has the same WUC but different alpha designators, and each can affect aircraft safety in a different way. Under the basic assumption that the failure rates of the individual item applications are essentially the same, an average sensitivity for the WUC was obtained by averaging the individual WUC sensitivity values.

The third special case treated by this phase of the program concerns WUC's involved in functions affected by provisory conditions. The diagram below illustrates this case:



The output of this phase of the program for a WUC in function A would consist of two sensitivity values for each phase of the mission. One would be the path 1 sensitivity of the WUC (path 1 could actually consist of several paths that have been combined), and the other would be the conditional sensitivity value for path 2. The combined sensitivity would then be calculated from the expression

$$S_c = P_W(S_1 + S_2 - S_1S_2) + (1 - P_W)S_1 = S_1 + P_WS_2 - S_1P_WS_2$$

where

S_c = combined sensitivity

S_1 = sensitivity of path 1

S_2 = sensitivity of path 2, conditional on the existence of provisory condition W

P_W = probability that condition W exists.

The last special case is for backup functions in redundant designs. Again, the sensitivity values shown (including path combined values) are conditional for WUC's in backup functions, and the computer output indicates that the sensitivity values must be multiplied by the failure probability of the primary mode function to obtain the unconditional sensitivity.

A printout of mission phase sensitivities for each WUC is included in Appendix D of this report.

4.6 CRITICALITY ASSESSMENT

4.6.1 General

The ARINC Research-produced sensitivity values are identified with respect to mission phase, and merging these with 3M WUC failures versus airframe time

required the allocation of failure probability to mission phase, computing phase criticalities, and then combining them for all mission phases. The basic model for element criticality was shown in Section 4.2.1. Its derivation and implementation is given in Appendix E.

It is required to obtain for each WUC an estimate of the probability that the WUC will be failed in the k^{th} phase (k=1, 2, . . . , 9). If we denote this probability by $P(\overline{WUC}, \phi_k)$, it is shown in Appendix E that overall WUC criticality can be estimated by

$$C_{WUC} = \sum_{k=1}^{9} P(\overline{WUC}, \phi_k) S_k$$

where S_k is the sensitivity of the WUC in the i^{th} phase.

From 3M data, one can obtain an estimate of the failure probability of the WUC on an average mission, such as through the equation

$$P(\overline{WUC}) = 1 - e^{-\lambda \bar{t}}$$

where λ is the observed failure rate given by 3M data, and $\bar{t}$ is the average mission length.

From the special survey of VF-121, it was possible to obtain for each major system the probability that the system is failed in the k^{th} phase* and the probability that the system fails sometime during flight. These probabilities for the j^{th} system will be denoted by $P(\overline{X}_j, \phi_k)$ and $P(\overline{X}_j)$, respectively. Then, if the WUC under consideration is located in system j, we have the estimating equation

$$P(\overline{WUC}, \phi_k) = P(\overline{WUC}) \frac{P(\overline{X}_j, \phi_k)}{P(\overline{X}_j)}$$

which is based on the assumption of equality of the ratios

$$\frac{P(\overline{WUC}, \phi_k)}{P(\overline{WUC})} \text{ and } \frac{P(\overline{X}_j, \phi_k)}{P(\overline{X}_j)} .$$

*It is noted that this probability includes the event that the k^{th} phase is attempted on a flight.

4.6.2 Criticality Model Exercise

Criticality assessment consists of 1) selection of the mission of interest – in this case, the average mission; 2) selection of the Provisory Factors for the conditions of interest; 3) inclusion of failure probability numbers; and 4) computation of the product of equipment failure probability and safety sensitivity (as modified by the Provisory Factor) for each phase of the mission.

The criticality computation program accepts Work Unit Code Sensitivity data (e.g., mission phase); 3M failure data; the number of flights corresponding to the 3M data and mission phase failure allocation ratios (from Miramar data), which are combined as described in Section 4.6.1 to arrive at the mission criticality.

The Naval Safety Center supplied the failure and flight data for the 12 months of May 1968 through April 1969, and a criticality model exercise was completed. Appendix B contains the results of this model exercise. The flow chart and program listing are contained in Appendix B. For purposes of this model exercise, all provisory factors were set to zero. Therefore the criticalities in Appendix D are representative of a "perfect" mission environment with field takeoff and landing and the presumption that emergency backup systems are available but not needed.

5
CONCLUSIONS

5.1 GENERAL

Analytical methods for quantifying safety indices have been successfully developed in accordance with the requirements of the contract. The methods developed still require considerable effort on the part of the Navy in their application and validation. Nevertheless, significant progress has been made in the formulation of techniques that permit accident exposure to be evaluated.

The analytical techniques have the ability to currently and continuously rank malfunction problems with respect to their accident potential. This ranking, based on criticality assessment, can provide the basic parameters necessary for analysis of safety versus cost for proposed aircraft modifications, changes in maintenance or flight operations, or even alternative aircraft designs.

The evaluation tool produced under this contract will not of itself reduce aircraft malfunction mishaps – only management actions and fiscal expenditures can do so. The utility of the safety assessments available from the application of this tool lies in its ability to alert commanders to the presence of malfunction safety problems and to quantitatively assign an importance to each.

Many malfunctions associated with aircraft operation have the property of only occasionally causing accidents. However, most mishaps are caused by such events, and it is this class of mishap for which the predictive aspects of this methodology will be effective.

The value of the predictive methodology lies in its responsiveness not only to extrapolation of historical accident rates but also to current operating data. Increased responsiveness to current operations make this method unique in its ability to flag events or operations most likely to produce unacceptably high accident risks.

5.2 SPECIFIC MODIFICATIONS REQUIRED

Interface problems with the existing 3M data system will probably require modification of the sensitivity values assigned to Work Unit Codes to compensate for the difference in the number of maintenance actions performed and the actual number of function-loss occurrences. WUC manual revisions may require reidentification of the WUC's, and major functional modifications to the aircraft will necessitate appropriate updating of the functional relationship documentation. The models developed must therefore be regarded as dynamic, continuing to evolve with the aircraft.

5.3 MAJOR COLLATERAL BENEFIT

Although the creation of flight-safety evaluation mathematical models suitable for exercise with existing data systems was the primary goal of this effort, a very significant and valuable by-product also resulted. This by-product – a functional sensitivity analysis methodology – has utility far beyond the specific application for which it was developed. By its application to the F-4J, the Navy has a summarized functional description of the aircraft. From this information, lists of functional effects of loss of equipment operation, as well as equipment candidates for causing functional loss, can easily be identified. Application of the appropriate Provisory Factors, will yield similar results for various environmental and operational conditions.

Analyses of the "fault tree" type can be obtained by the same computer program used to generate this equipment/path sensitivity tape by selecting and reading-in the function of interest (e.g., landing gear extension). The resulting output will provide a comprehensive functional relationship tree, including appropriate Provisory Factors applicable to each branch and a quantified assessment of how important each function and equipment was to the function of interest.

The versatility of application of this functional documentation is the direct result of the individual documentation of each immediate functional relationship, the original purpose of which was to provide increased uniformity and standardization of documentation among the analysts performing the task. Computerization of the functional analyses has had the effect of 1) assuring uniformity of analytical criteria, 2) providing automatic cross-checks of individual functional relationships, and 3) providing versatility in output capability; all of which would have been unavailable with manual recording and retrieval systems.

APPENDIX A

FUNCTIONAL ANALYSIS OF F-4J AIRCRAFT

CONTENTS, APPENDIX A

A.1 GENERAL

This appendix contains the results of the functional analysis performed by ARINC Research for the F-4J aircraft. The tab locators identify nine primary and one secondary functional aircraft system (no diagram is included for the "Pilot"). The functional sections are lettered and the pages numbered according to function level. The title block on each functional diagram identifies the NAVAIR documents (including dates) used in construction of the functional diagram. In cases where the NAVAIR document described several configurations for aircraft block groups, the latest configuration was used for the diagram.

Wherever possible, diagrams are laid out with the inputs on the left side of the page and continuing through the sequence of events to the final function on the right side of the page. Unlike a reliability block diagram, in which blocks in series indicate a tying together physically of equipments, the series of blocks in these diagrams will indicate that if all of the input events to the left of a block occur, and the equipment unique to the functional block is operating, then that function will have been performed.

A form of shorthand logic symbology was used to depict the functional relationships, in which each input to a functional block which enters with a unique arrowhead can be considered AND functions, and inputs whose function lines are joined prior to the arrow entering the next functional block can be considered OR functions. Figure A-1 represents this relationship.

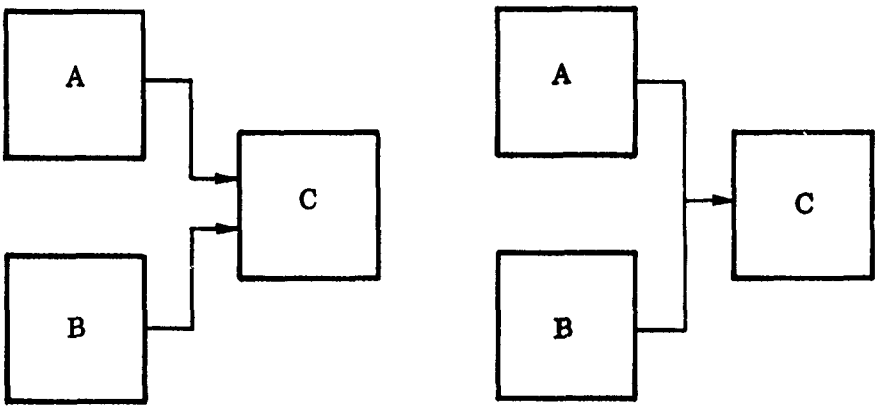


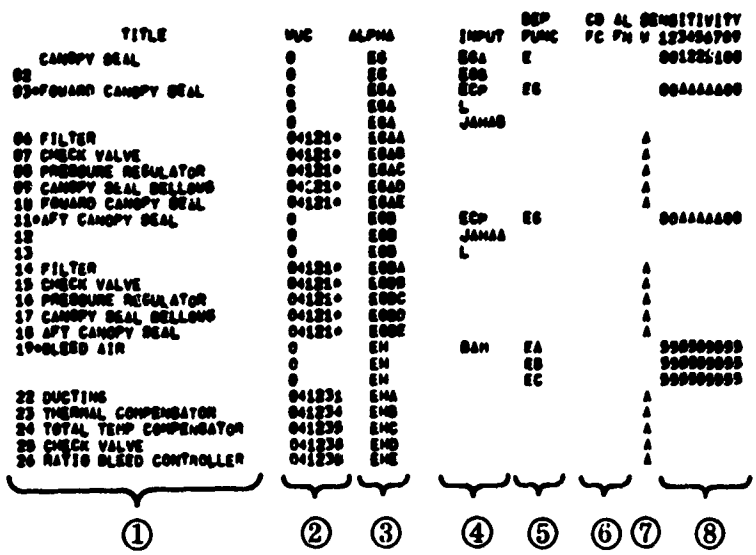
Figure A-1

A.2 ORGANIZATION

The functional description portion of this appendix is divided into ten sections. The first section describes the aircraft, in general. This diagram depicts the primary aircraft functions, together with the alpha designator assigned to each. For instance, the alpha designator "A" will prefix all functions and equipments associated with ground control of the aircraft, all of which will be found behind Tab A, Ground Control. On the tab sheet will be the functional breakdown of the primary function, together with a listing of the order in which the diagrams will appear. Following the diagrams in each section will be a computer listing of the function cards, showing inputs required and dependent functions; and of work unit codes, together with the function and in the functional chain to which the WUC operation contributes. The WUC's used to identify equipment types are as documented in NAVAIR 01-245FD-8, revised 1 June 1968.

If more than one piece of equipment with the same WUC is installed in the aircraft, each will be identified with a different alpha designator. If the same piece of equipment performs more than one function or operates in more than one functional branch, it would maintain only one alpha designator for all of the applications. This, therefore, provides a method for determining whether one piece of equipment has many effects, or whether many pieces of the same equipment are used in the aircraft, each providing one or many different effects.

The following page provides a guide for reading the printouts in this appendix.



	TITLE	WUC	ALPHA	INPUT	DEP FUNC	CD FC	AL PN	SENSITIVITY M
	CANOPY SEAL	0	EG	EGA	E			001225100
02		0	EG	EGB				
03	FORWARD CANOPY SEAL	0	EGA	ECP	EG			004444400
		0	EGA	L				
		0	EGA	JANAB				
06	FILTER	041231	EGAA				A	
07	CHECK VALVE	041231	EGAB				A	
08	PRESSURE REGULATOR	041231	EGAC				A	
09	CANOPY SEAL BELLOWS	041231	EGAD				A	
10	FORWARD CANOPY SEAL	041231	EGAE				A	
11	AFT CANOPY SEAL	0	EGB	ECP	EG			004444400
12		0	EGB	JANAB				
13		0	EGB	L				
14	FILTER	041231	EGBA				A	
15	CHECK VALVE	041231	EGBB				A	
16	PRESSURE REGULATOR	041231	EGBC				A	
17	CANOPY SEAL BELLOWS	041231	EGBD				A	
18	AFT CANOPY SEAL	041231	EGBE				A	
19	BLEED AIR	0	EH	BAM	EA			990000099
		0	EH		EB			990000095
		0	EH		EC			990000093
22	DUCTING	041231	EHA				A	
23	THERMAL COMPENSATOR	041234	EHB				A	
24	TOTAL TEMP COMPENSATOR	041239	EHC				A	
25	CHECK VALVE	041230	EHD				A	
26	RATIO BLEED CONTROLLER	041230	EHE				A	

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

① Function or Equipment Name

② Work Unit Code Number

③ "Alpha" Designator for WUC or Function (may be preceded by an R or L indicating right and left)

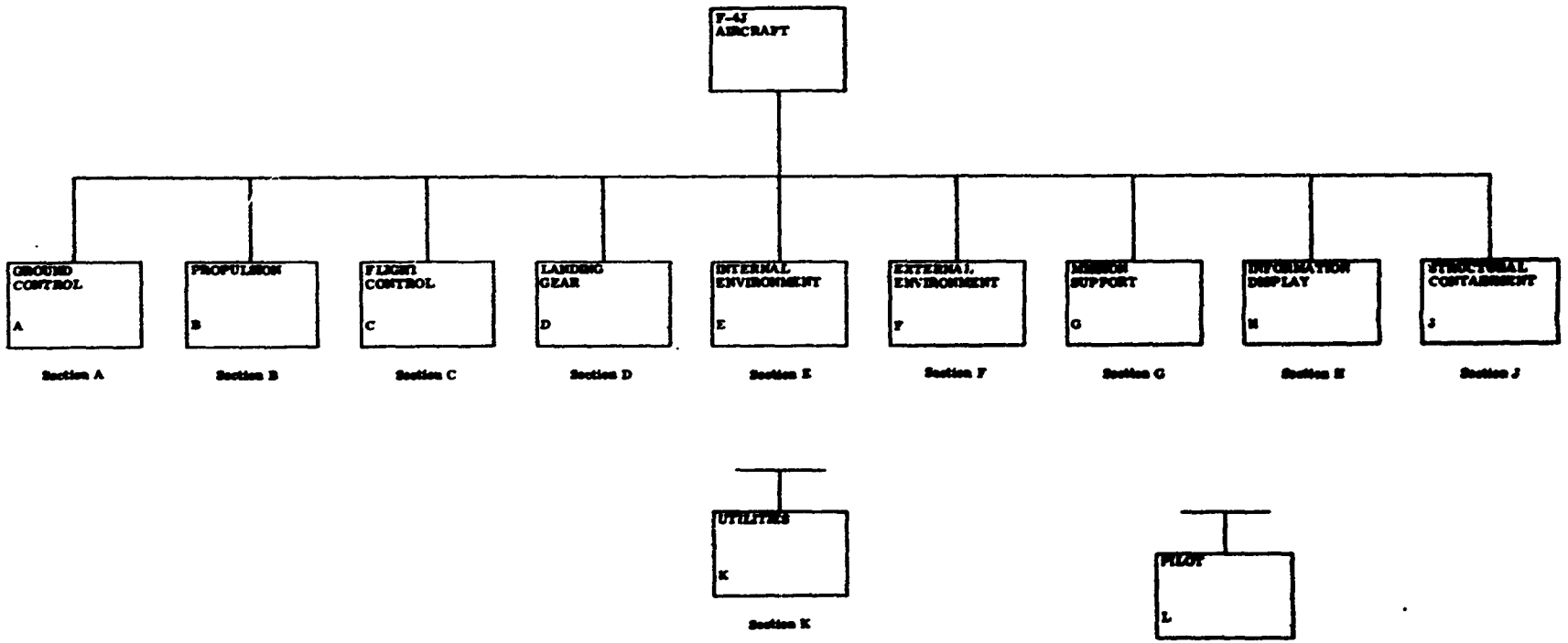
④ Functional "Inputs" Required

⑤ Dependent Functions of Function listed under "Alpha"

⑥ Conditional or Provisory Factor and Alpha Designator for alternate function if applicable

⑦ Sensitivity value for WUC with respect to function listed above it. (Values are A = 1.0, 9 = 0.90, 8 = 0.80, etc.)

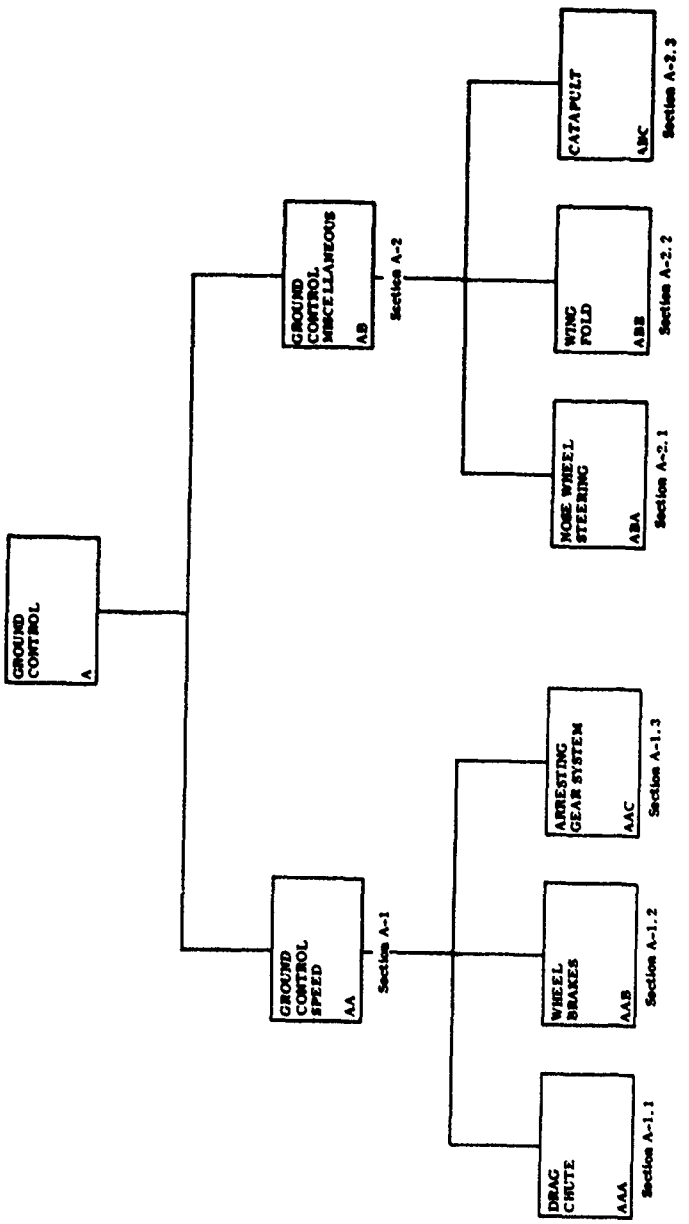
⑧ Functional Sensitivity with respect to the listed dependent function by Mission Phase



Aircraft: F-4J	
Title: Functional Diagram AIRCRAFT, GENERAL	
Document: NA	rev. date NA
Date: 23 Apr 1969	

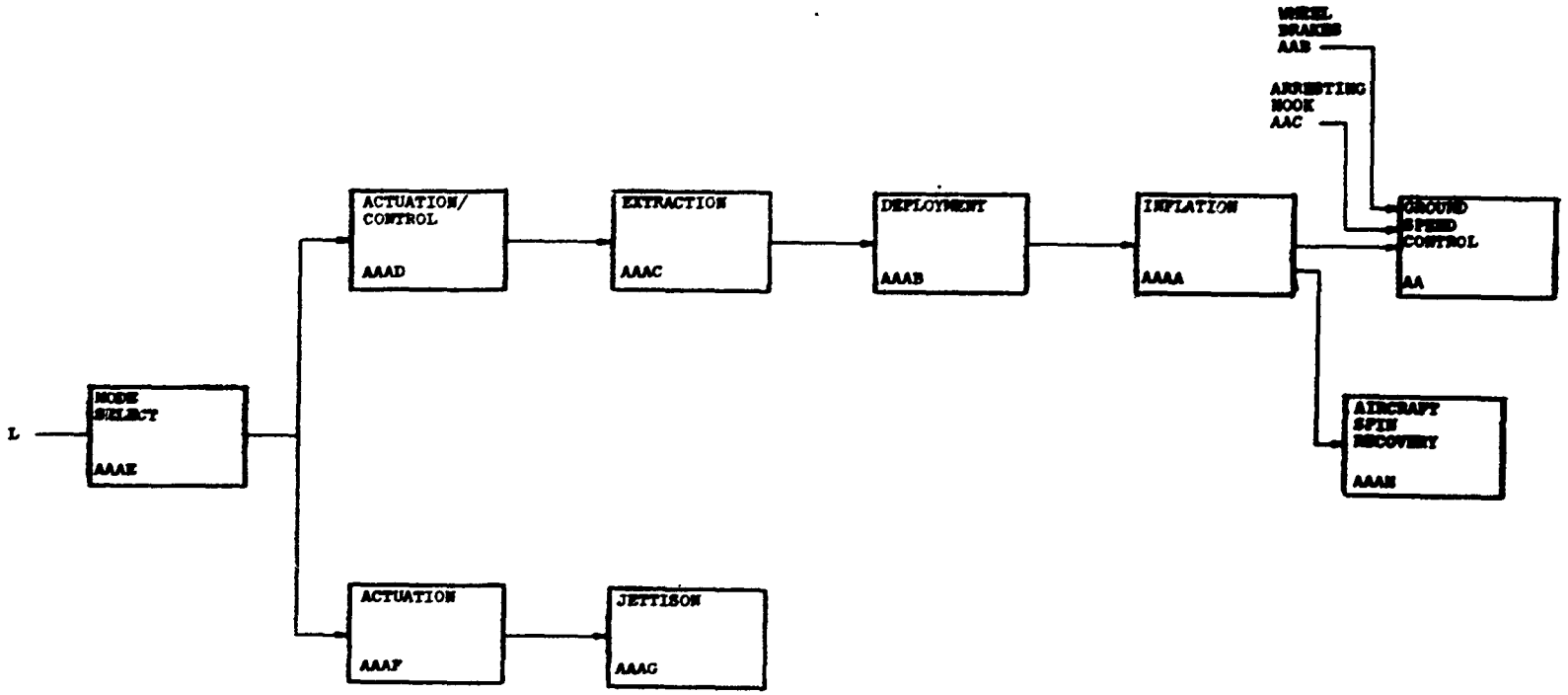
APPENDIX A

A. GROUND CONTROL SECTION



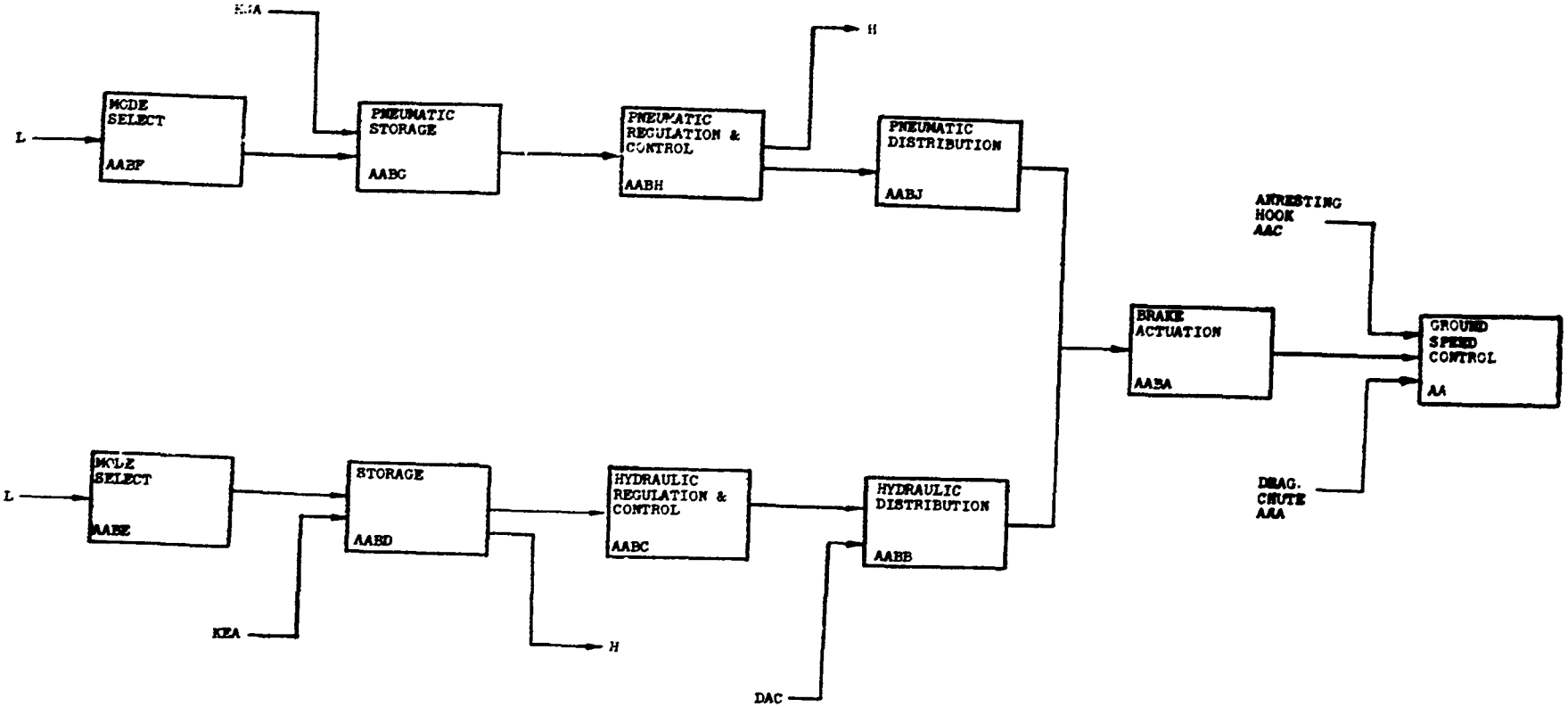
Aircraft: F-4J	
Title: Functional Diagram	GROUND CONTROL SECTION
Document: XA	rev. date XA
Date: 23 Apr 1969	

Section A



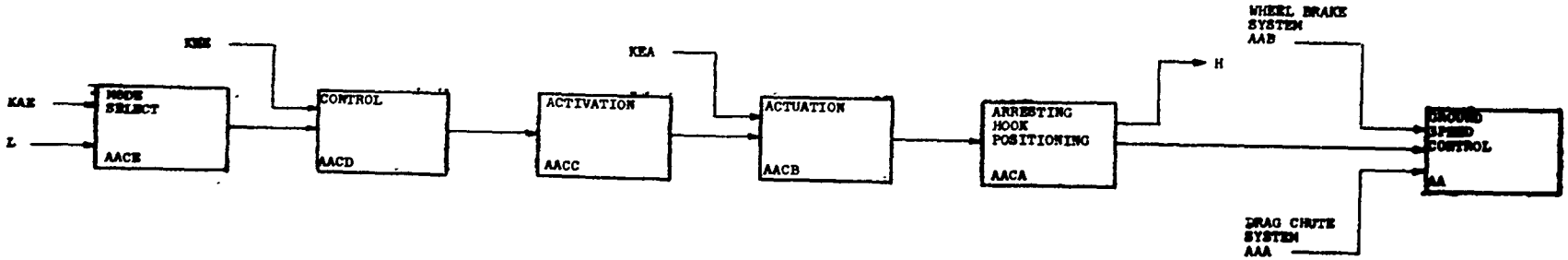
Section A-1.1

Aircraft: F-4J	
Title: Functional Diagram DRAG CHUTE SYSTEM (AAA)	
Document: NAVAIR 01-245PDB-2-2.3	**rev. date** 15 Jun 1968
Date: 23 Apr 1969	



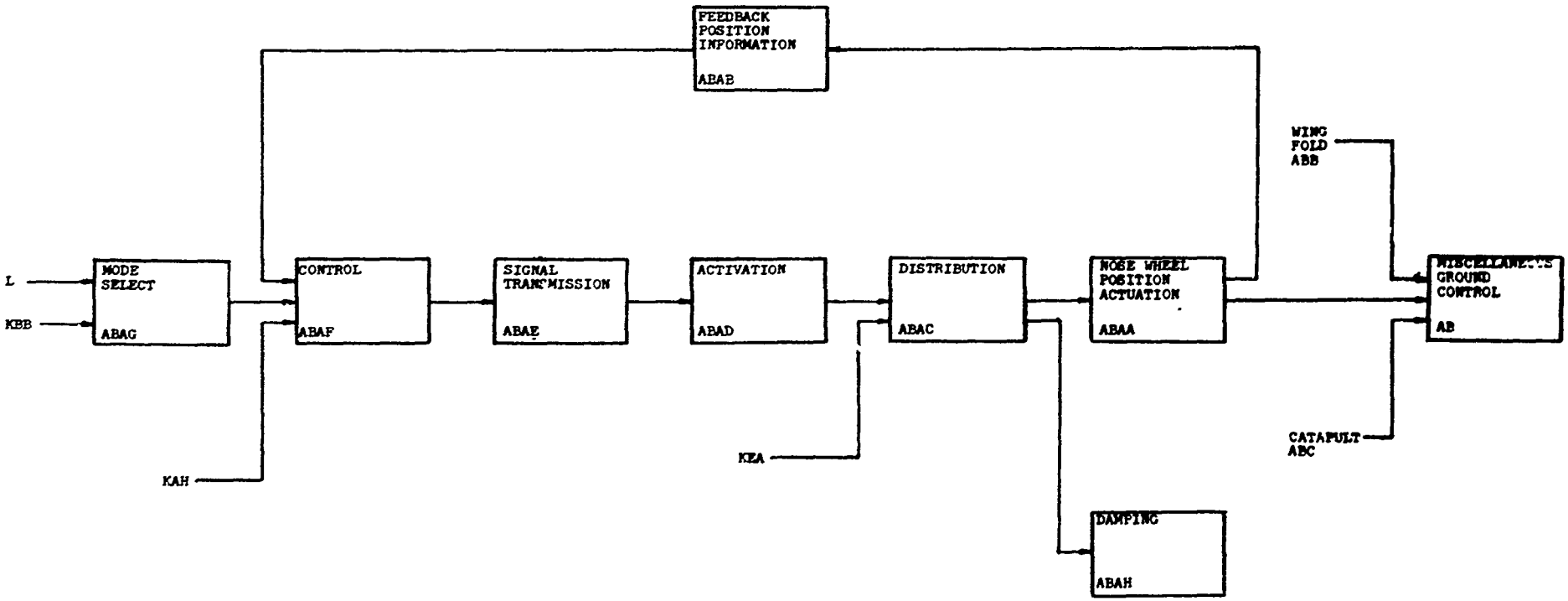
Aircraft: F-4J	
Title: Functional Diagram WHEEL BRAKE SYSTEM	
Document: NAVAIR [illegible]	**rev. date** [illegible]
Date: [illegible]	

ARINC

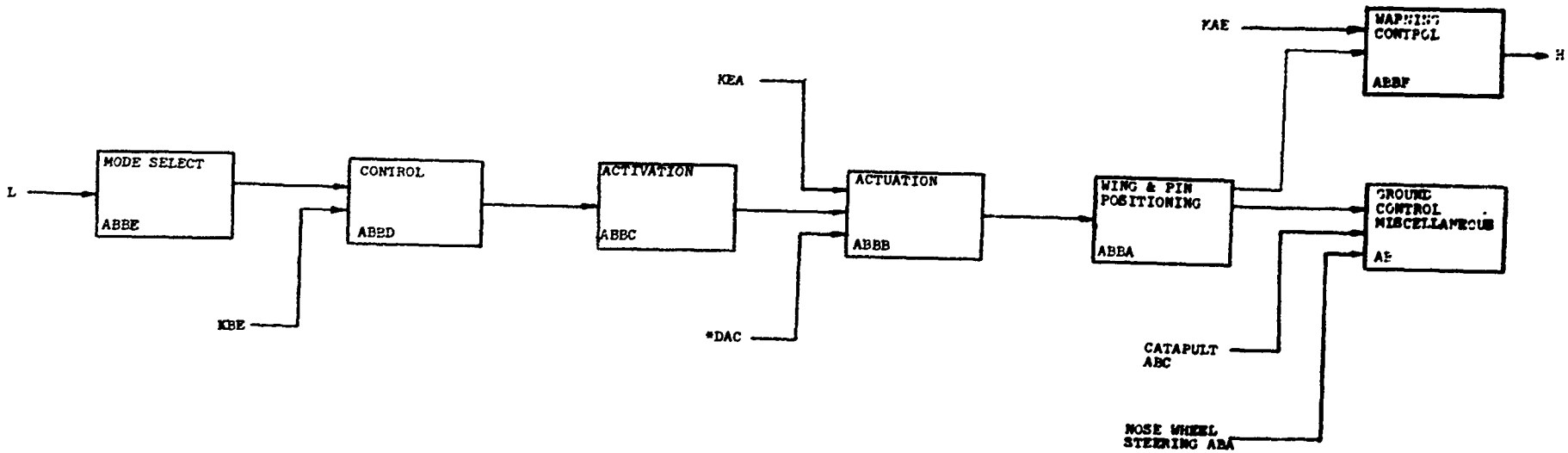


Aircraft: F-4J	
Title: Functional Diagram ARRESTING GEAR SYSTEM (AAC)	
Document: NAVAIR 01-245FDE-2-2.3	**rev. date** 15 Jun 1968
Date: 25 Apr 1969	

ARINC



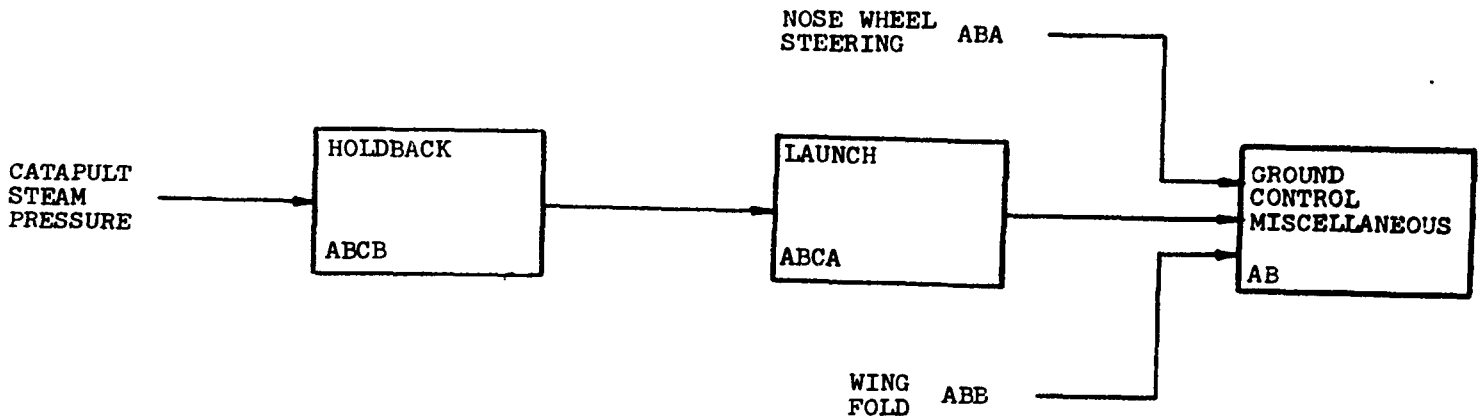
Aircraft: F-4J	
Title: Functional Diagram NOSE WHEEL STEERING SYSTEM	
Document:	**rev. date**
Date:	



Section A-12

Aircraft: F-4J	
Title: Functional Diagram WING FOLD SYSTEM (ABB)	
Document: NAVAIR 01-245[illegible]-2.2	**rev. date** 1 Jul 19[illegible]
Date: 25 Apr 19[illegible]	

*NOTE: DAC is landing gear down line, KEA is utility hydraulics distribution. Both inputs are shown because both are needed for actuation function. However, schematic (Fig. 1-C Wing Fold System Schematic, NAVAIR 01-245[illegible]-2.2) shows only one input from landing gear hydraulic down line.



Aircraft: F-4J	
Title: Functional Diagram CATAPULT SYSTEM (ABC)	
Document: NAVAIR 01-245FDB-2-2.3	**rev. date** 15 Jun 1968
Date: 23 Apr 1969	

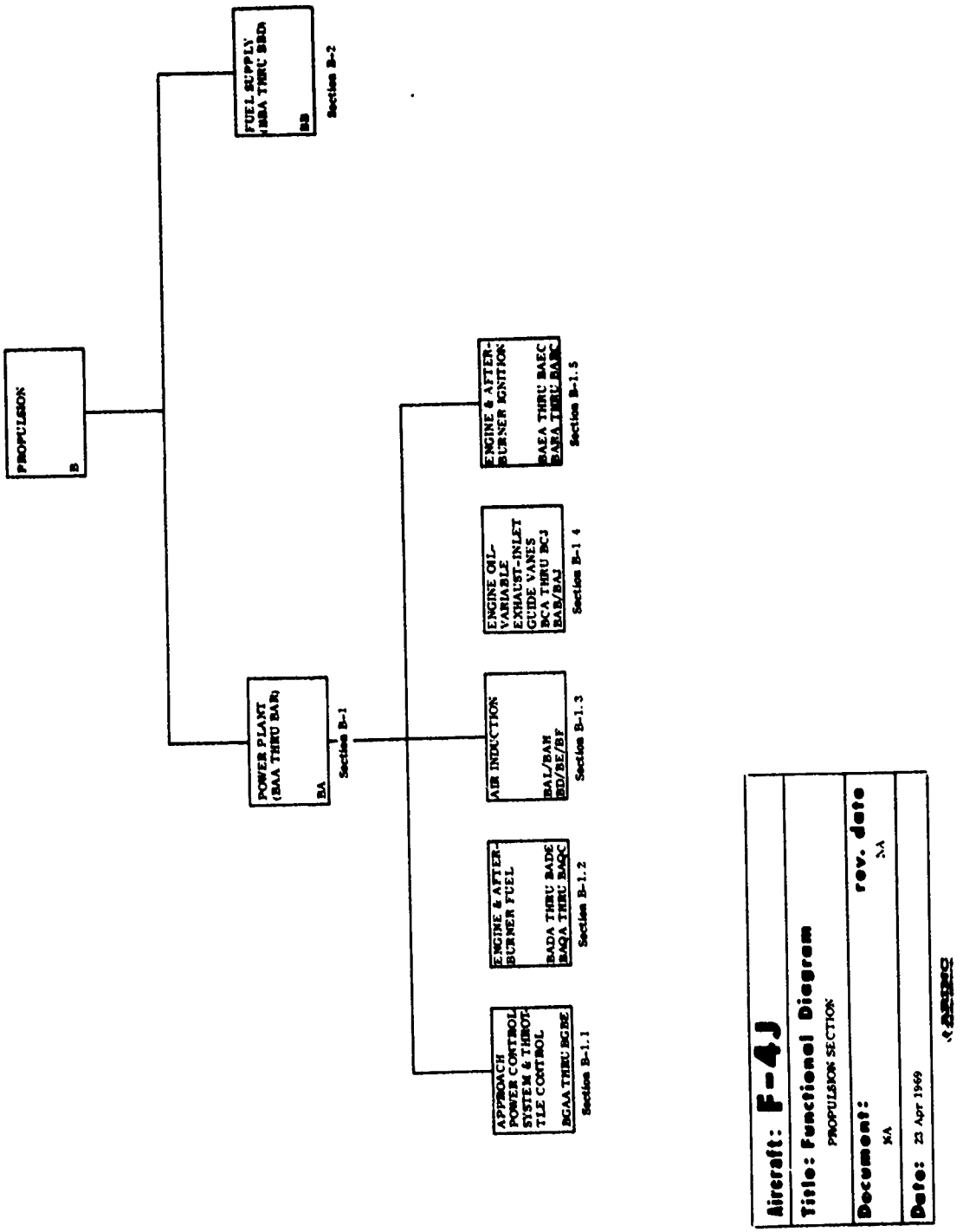
ARINC

	TITLE	WBC	ALPHA	INPUT	DEP FUNC	CD FC	AL SENSITIVITY FN W 123456789
	GROUND SPEED CONTROL	1	AA	AAAA			300000083
37		1	AA	AAB			
37		1	AA	AAC			
	*DRAG CHUTE INFLATION	1	AAAA	AAAH	AA	KCAABA	020000040
	DRAG CHUTE INFLATION	1	AAAA		AAAH		000222000
40	DRAG CHUTE CANOPY	19321210	AAAAA			A	
	DRAG CHUTE DEPLOYMENT	1	AAAB	AAAC	AAAA		AAAAAAAAA
42	RISER	19321220	AAAHA			6	
43	RISER LINKS	19321260	AAAHC			5	
	DRAG CHUTE EXTRACTION	1	AAAC	AAAD	AAAH		AAAAAAAAA
45	PILOT CHUTE	19321250	AAACA			A	
46	BRIDLE	19321240	AAACH			A	
47	CHUTE CONTAINER BAG	193211	AAACC			A	
	DRAG CHUTE ACTUATION-CONTRL	1	AAAD	AAAE	AAAC		AAAAAAAAA
49	CHUTE DOOR	193213	AAADA			A	
50	ACTUATOR	193214	AAADH			A	
51	DOOR LATCH MECHANISM	193216	AAADC			A	
52	DOOR HINGE	193215	AAADD			A	
53	RELEASE CABLE	193112	AAADE			A	
54	HOOK ASSEMBLY	193113	AAADF			A	
55	LOCK MECHANISM	193114	AAADG			A	
56	CABLE FAIRLEAD/PULLEY	193115	AAADH			A	
57	TORQUE TUBE ASSEMBLY	193116	AAADJ			A	
58	ROD ASSEMBLY	193118	AAADK			A	
59	CAM ATTACH LINK	19311A	AAADL			A	
60	BELLCRANK ASSY	19311B	AAADM			A	
	MODE SELECT	1	AAAE	L	AAAD		AAAAAAAAA
		1	AAAE		AAAF		080000000
63	DRAG CHUTE HANDLE	193111	AAAEA			A	
	JETTISON ACTUATION	1	AAAF	AAAE	AAAG		AAAAAAAAA
65	RELEASE EXT SPRING	193117	AAAFA			A	
66	RELEASE MECHANISM KEEPER	19311C	AAAFH			A	
67	RELEASE SWITCH	19311D	AAAFC			A	
68	*BRAKE ACTUATION	1	AABA	AABJ	AA	CH	100000051
		1	AABA	AABB			
70	WHEEL BRAKE ASSEMBLY	113418	RAABAA			A	
71	WHEEL BRAKE ASSEMBLY	113418	LAABAB			A	
	HYDRAULIC DISTRIBUTION	1	AABB	AABC	AABA		555555555
73		1	AABB	DAC			
74	CHECK VALVE-HYD RETURN-A/S	11341*	RAABBA			A	
75	CHECK VALVE-HYD RETURN-A/S	11341*	LAABBB			A	
76	TWO WAY RESTRICTOR	11341*	AABBC			A	
77	CHECK VALVE-HYD INLET	11341*	AABBD			A	
78	CHECK VALVE-ANTI SPIN	11341*	AABBE			A	
79	HYD FILTER	113418	AABBF			A	
80	TUBING	11341*	AABBG			A	
	HYD REGULATION + CONTROL	11341*	AABC	AABD	AABH		AAAAAAAAA
82	ONE WAY RESTRICTOR-INLET	11341*	RAABCA			A	
83	ONE WAY RESTRICTOR-INLET	11341*	LAABCB			A	
84	ONE WAY RESTRICTOR-RETURN	11341*	RAABCC			A	
85	ONE WAY RESTRICTOR-RETURN	11341*	LAABCD			A	
86	BRAKE CONTROL VALVE	113411	RAABCE			A	
87	BRAKE CONTROL VALVE	113411	LAABCF			A	
	STORAGE	1	AABD	AABE	AABC		AAAAAAAAA
89		1	AABD	KEA	H		AAAAAAAAA
90	AIR CHARGE VALVE	11342*	AABDA			A	
91	ACCUMULATOR	113425	AABDB			A	
	MODE SELECT	1	AABF	L	AABG		AAAAAAAAA
93	BRAKE PEDAL	11341C	RAABFA			A	
94	BRAKE PEDAL	11341C	LAABFB			A	
95	RUDDER PEDAL LINKAGE	113412	RAABFC			A	
96	RUDDER PEDAL LINKAGE	113412	LAABFD			A	
97	BELLCRANK	113414	RAABFE			A	
98	BELLCRANK	113413	LAABFF			A	
	MODE SELECT	1	AABE	L	AABD		AAAAAAAAA
A0	HANDLE	113421	AABFA			A	
A1	LINKAGE	113423	AABFB			A	
	PNEUMATIC STORAGE	1	AABG	AABF	AABH		AAAAAAAAA
A3		1	AABG	PGA			
A4	VENT RELIEF VALVE	11342*	AABGA			A	
A5	AIR BOTTLE	113424	AABGB			A	
	PNEU REG + CONTROL	1	AABH	AABG	AABJ		AAAAAAAAA
		1	AABH		H		000000010
A8	AIR SELECTOR VALVE	113422	AABHA			A	
A9	CHECK VALVE	11342*	AABHB			A	
	PNEUMATIC DISTRIBUTION	1	AABJ	AABH	AABA		AAAAAAAAA
B1	FILTER-SCREEN	11342*	AABJA			A	
B2	PNEUMATIC LINES	11342*	AABJB			A	
	*ARRESTING HOOK POSITIONING	1	AACA	AACH	AA	CH	010000040
		1	AACA		H		030000010

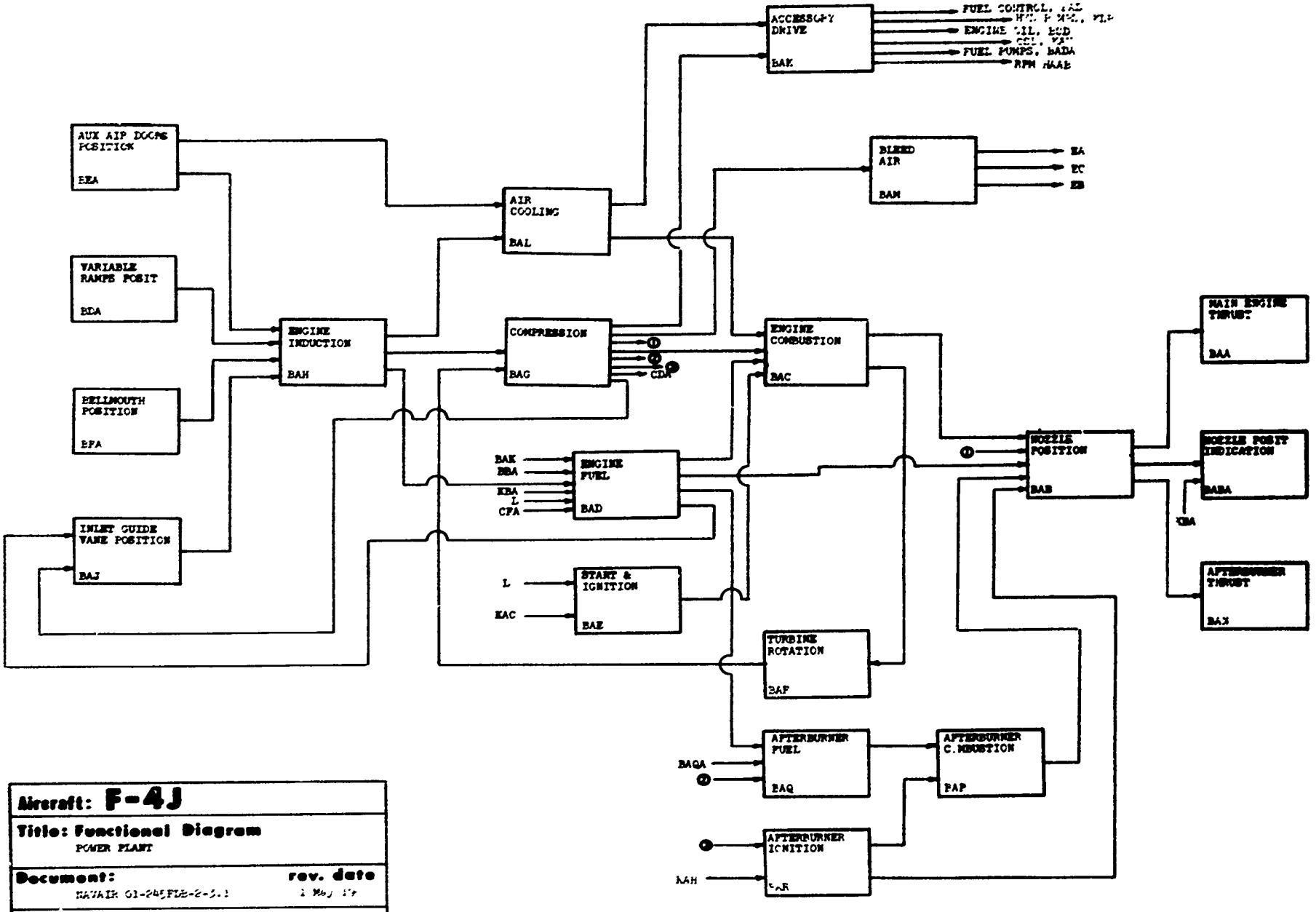
03 HOOK AND FAIRING ASSY	113820	AACAA				A	
VERTICAL DAMPER CYLINDER	113511	AACAB				A	
05 HORIZONTAL DAMPER	11351E	RAACAC				S	
06 HORIZONTAL DAMPER	11351E	LAACAD				S	
07 CENTERING SPRING CYL ASSY	113516	RAACAE				S	
08 CENTERING SPRING CYL ASSY	113516	LAACAF				S	
09 AIR-OIL MANIFOLD	113515	AACAG				A	
10 AIR CHARGE VALVE	113514	AACAH				A	
ACTUATION	1	AACB	AACC	AACA			AAAAAAAAA
12	1	AACB	KEA				
13 BLEEDER PLUG	11351*	AACBA				A	
14 TWO WAY RESTRICTOR	11351*	AACBB				A	
15 HOOK UPLATCH MECHANISIM	11351C	AACBC				A	
16 TUBING	11351*	AACBD				A	
ACTIVATION	1	AACC	AACD	AACB			AAAAAAAAA
18 SOLENOID SELECTOR VALVE	11351D	AACCA				A	
19 CHECK VALVE	11351*	AACCB				A	
20 TIME DELAY RELAY PANEL	11351*	AACCC				A	
CONTROL	1	AACD	AACE	AACC			AAAAAAAAA
	1	AACD	KBE				
23 SURGE DAMPER	113512	AACDA				A	
24 5 AMP FUSE	11351*	AACDB				A	
25 ARRESTING GEAR CONTROL SW	11351N	AACDC				A	
26 CONTROL CABLE ASSY	11351*	AACDD				A	
27 PULLEYS-FAIRLEADS	11351*	AACDE				A	
MODE SELECT	1	AACE	KAE	AACD			AAAAAAAAA
29	1	AACE	L				
30 CONTROL LEVER	113518	AACEA				A	
31 LEVER WARNING LITE	113541	AACEB				A	
32 HOOK DOWN LIMIT SWITCH	113532	AACEC				A	
33 HOOK UP LIMIT SWITCH	113531	AACED				A	
34 WARNING LITE SWITCH	113543	AACEE				A	
35 5 AMP FUSE	11353*	AACEF				A	
*MISC GROUND CONTROL	2	AB	ABAA				182222271
	2	AB	ABB				
	2	AB	ABC				
*NOSE WHEEL POSITION ACTUATN	2	ABAA	ABAC	ABAB			AAAAAAAAA
	2	ABAA		AB			AA00000AA
01 STEERING POWER UNIT	213342	ABAAA				A	
02 SERVO VALVE	213348	ABAAB				A	
03 COLLAR/GEAR ASSEMBLY	21334B	ABAAC				A	
FEEDBACK POSITION INFO	2	ABAB	ABAA	ABAF			AAAAAAAAA
05 FOLLOW UP POTENTIOMETER	213347	ABABA				A	
DISTRIBUTION	2	ABAC	ABAD	ABAA			AAAAAAAAA
	2	ABAC	KEA	ABAH			AAAAAAAAA
07 SELECTR VLV RETURN CHK VLV	21334*	ABACA				A	
08 TWO WAY RESTRICTOR	21334*	ABACB				A	
09 PRESS CHECK VLV-64	21334*	ABACC				A	
10 PRESS CHECK VLV-63	21334*	ABACD				A	
11 FILTER ASSY	213346	ABACE				A	
ACTIVATION	2	ABAD	ABAE	ABAC			AAAAAAAAA
13 SELECTOR VALVE	21334A	ABADA				A	
SIGNAL TRANSMISSION	2	ABAE	ABAF	ABAD			AAAAAAAAA
15 ACCELOROMETER POWER RELAY	21334*	ABAEA				A	
16 COMMAND POTENTIOMETER	213344	ABAEB				A	
17 AUX AIR DOOR RELAY	21133*	BEFA				A	
CONTROL	2	ABAF	ABAG	ABAE			AAAAAAAAA
19	2	ABAF	AHAB				
19	2	ABAF	KAH				
20 CONTROL UNIT	213343	ABAFA				A	
21 LNDNG GEAR CONTROL SWITCH	213112	DADB				A	
22 MOTIONAL PICKUP TRANSDUCER	21334N	ABAFC				A	
23 RMLG SCISSOR SWITCH	21323*	RDABARB				A	
24 NOSE GEAR DOWN LIMIT SWITCH	213143	DAABAA				A	
MODE SELECT	2	ABAG	KBB	ABAF			AAAAAAAAA
	2	ABAG	L				
27 NOSE WHEEL STEERING SWITCH	21334L	ABAGA				A	
28 RUDDER PEDAL	214428	RABAGB				A	
29 RUDDER PEDAL	214428	LABAGC				A	
30 TORQUE TUBE	21334C	ABAGD				A	
31 DAMPING	2	ABAH	ABAC				0A00000A0
32 POWER UNIT COMPENSATOR	213341	ABAHA				A	
33 COMPENSATOR CHECK VALVE	21334*	ABAHB				A	
34*LAUNCH	2	ABCA	AHCB	AB	P		070000000
35 LAUNCH/TOW HOOK	213611	RABCAA				A	
36 LAUNCH/TOW HOOK	213611	LABCAB				A	
37 HOLDBACK	2	ABCB		ABCA			0A0000000
38 HOLDBACK FITTING	213612	ABCBA				A	
39 TENSION BAR	213613	ABCBB				A	
41*WING AND PIN POSITIONING	2	ABBA	ABBB	AB			044404450
	2	ABBA		ABBF			AAAAAAAAA

43	WINGFOLD PIN PULL CYLINDER	214811	RAHHAA			A		
44	WINGFOLD PIN PULL CYLINDER	214811	LARBAB			A		
45	WING HINGE	21481*	RABBAC			A		
46	WING HINGE	21481*	LABBAD			A		
47	W/F PIN ACTUATOR BAR	214818	RABBAE			A		
48	W/F PIN ACTUATOR BAR	214818	LABBAF			A		
	ACTUATION	2	ABBB	ABBC	AHHA		AAAAAAAAA	
50		2	ABBB	KEA				
50		2	ABBB	UAC				
51	WINGFOLD ACTUATOR CYLINDER	214812	RABBBA			A		
52	WINGFOLD ACTUATOR CYLINDER	214812	LABBBB			A		
53	TWO WAY RESTRICTOR-SPREAD	21481*	RABBBC			A		
54	TWO WAY RESTRICTOR-FOLD	21481*	RABBBD			A		
55	TWO WAY RESTRICTOR-SPREAD	21481*	LABBBE			A		
56	TWO WAY RESTRICTOR-FOLD	21481*	LABBBF			A		
	ACTIVATION	2	ABBC	ABBD	ABBB		AAAAAAAAA	
58		2	ABBC	KHE				
59	PIN PULL SELECTOR VALVE	214814	RABBCA			A		
60	PIN PULL SELECTOR VALVE	214814	LABBCB			A		
61	WINGFOLD SELECTOR VALVE	214815	RABBCC			A		
62	WINGFOLD SELECTOR VALVE	214815	LABBCD			A		
	CONTROL	2	ABBD	ABBE	ABBC		AAAAAAAAA	
64	WING SPREAD LIMIT SWITCH	214823	RABBDA			A		
65	WING SPREAD LIMIT-SWITCH	214823	LABBDB			A		
66	WING PIN OUT LIMIT SWITCH	214822	RABBDC			A		
67	WING PIN OUT LIMIT SWITCH	214822	LABBDD			A		
68	MANUAL PIN OUT LIMIT Sw	21482*	RABBDE			A		
69	MANUAL PIN OUT LIMIT Sw	21482*	LABBDF			A		
70	LOCKPIN IN LIMIT SWITCH	214822	RABBDG			A		
71	LOCKPIN IN LIMIT SWITCH	214822	LABBDH			A		
	MODE SELECT	2	ABBE	L	ABBD		AAAAAAAAA	
73	WINGFOLD CONTROL SWITCH	214825	ABBEA			A		
74	WINGFOLD CONTROL BOX	21481A	RABBEB			A		
75	WINGFOLD CONTROL BOX	21481A	LABBEC			A		
76	LOCKPIN CONTROL BOX	21481*	RABBED			A		
77	LOCKPIN CONTROL BOX	21481*	LABBEE			A		
78	MANUAL LOCKPIN HANDLE	214818	ABBEF			A		
	WARNING CONTROL	2	ABBF	ABBA	H		AAAAAAAAA	
80		2	ABBF	KAE				
81	FWD COCKPIT LITE TEST RELAY	21482*	RABBFA			A		
82	AFT COCKPIT LITE TEST RELAY	21482*	RABBFB			A		
83	FWD COCKPIT LITE TEST RELAY	21482*	LABBFC			A		
84	AFT COCKPIT LITE TEST RELAY	21482*	LABBFD			A		
85	FWD COCKPIT LITE	21482*	RABBFE			A		
86	AFT COCKPIT LITE	21482*	RABBFF			A		
77	FWD COCKPIT LITE	21482*	LABBFG			A		
88	AFT COCKPIT LITE	21482*	LABBFH			A		

B. PROPULSION SECTION



Section B

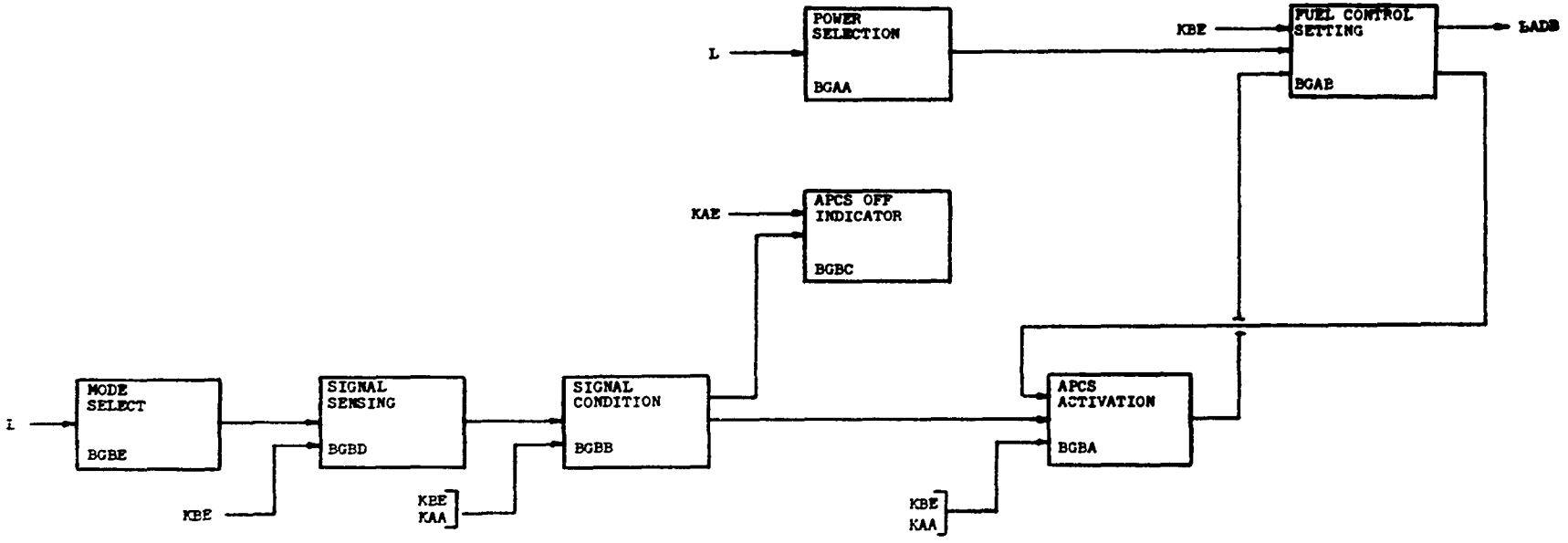


Aircraft: F-4J

Title: Functional Diagram
POWER PLANT

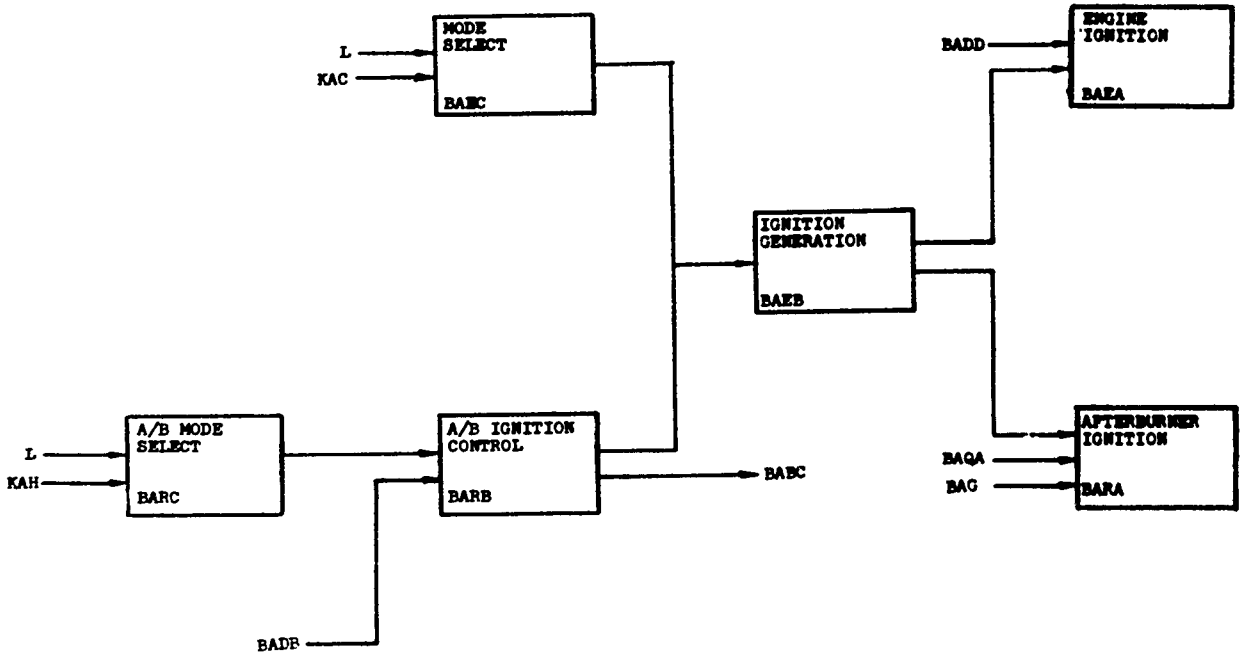
Document: NAVAIR 01-245FLE-2-5.1 rev. date

Date:



Aircraft: F-4J	
Title: Functional Diagram APPROACH POWER CONTROL SYSTEM & THROTTLE CONTROL	
Document: NAVAIR 01-245FDE-[illegible]	**rev. date** 1 [illegible] 196[illegible]
Date: [illegible]	

ARINC



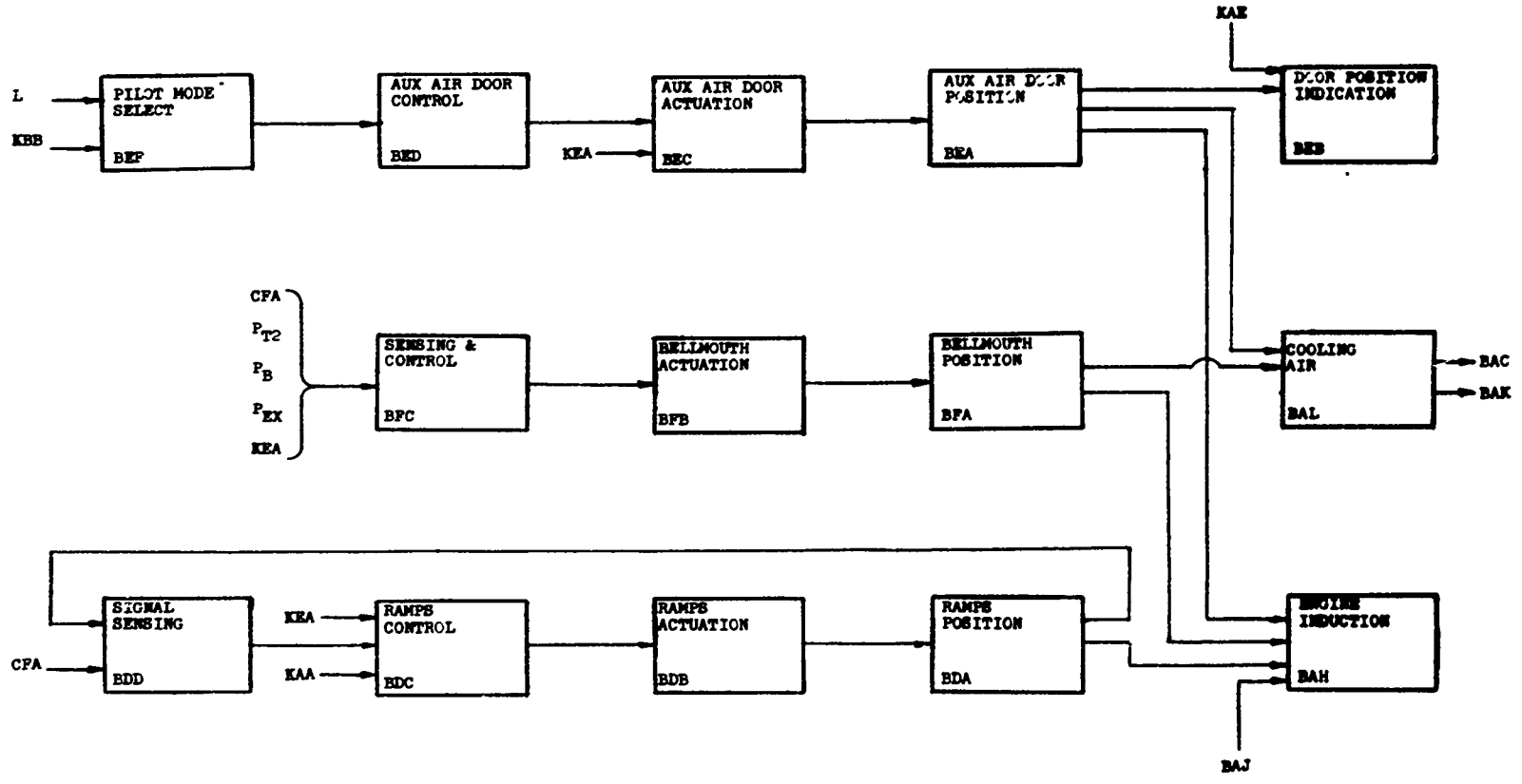
Aircraft: F-4J

Title: Functional Diagram
ENGINE & AFTERBURNER IGNITION

Document: NAVAIR 01-245FDB-2-3.1 **rev. date** 1 May 1973

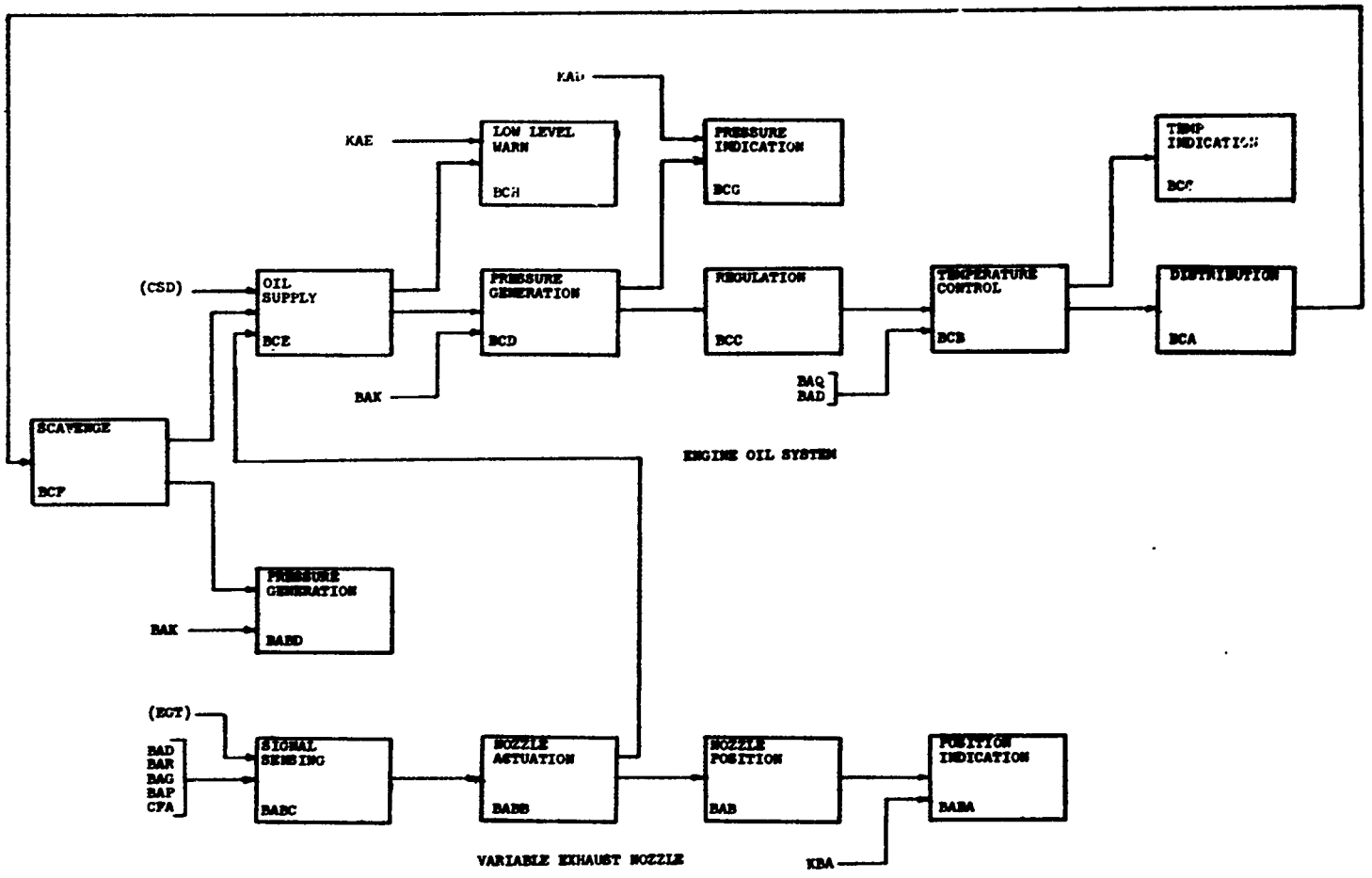
Date: 23 Apr 1973

Section B-1.2



Aircraft: F-4J	
Title: Functional Diagram AIR INDUCTION	
Document: NAVAIR 01-245FDE-2-3.2	**rev. date** 15 Oct 1967
Date:	

ARINC



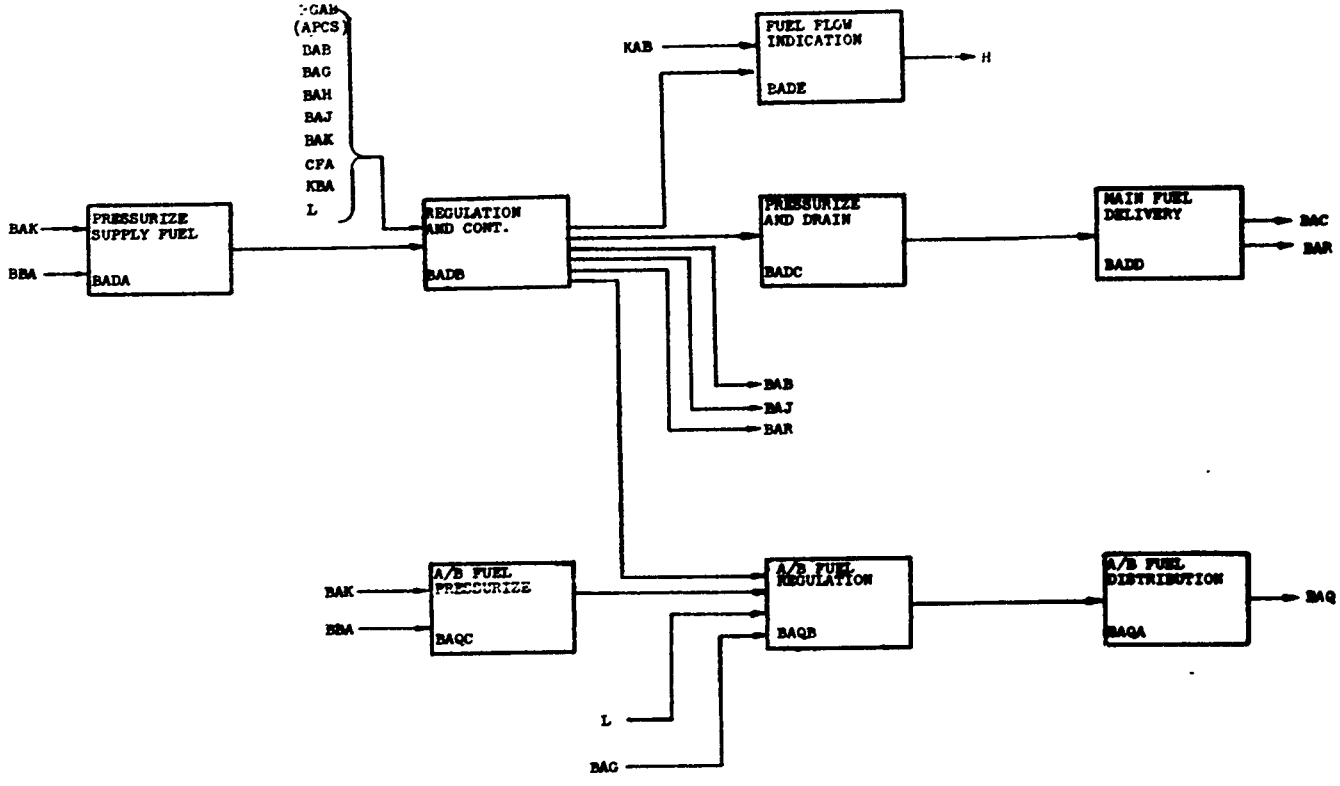
Aircraft: F-4J

Title: Functional Diagram
ENGINE OIL - VARIABLE EXHAUST - INLET GUIDE VANES

Document: NAVAIR 01-245FDB-2-3.1 **rev. date** 1 May 1968

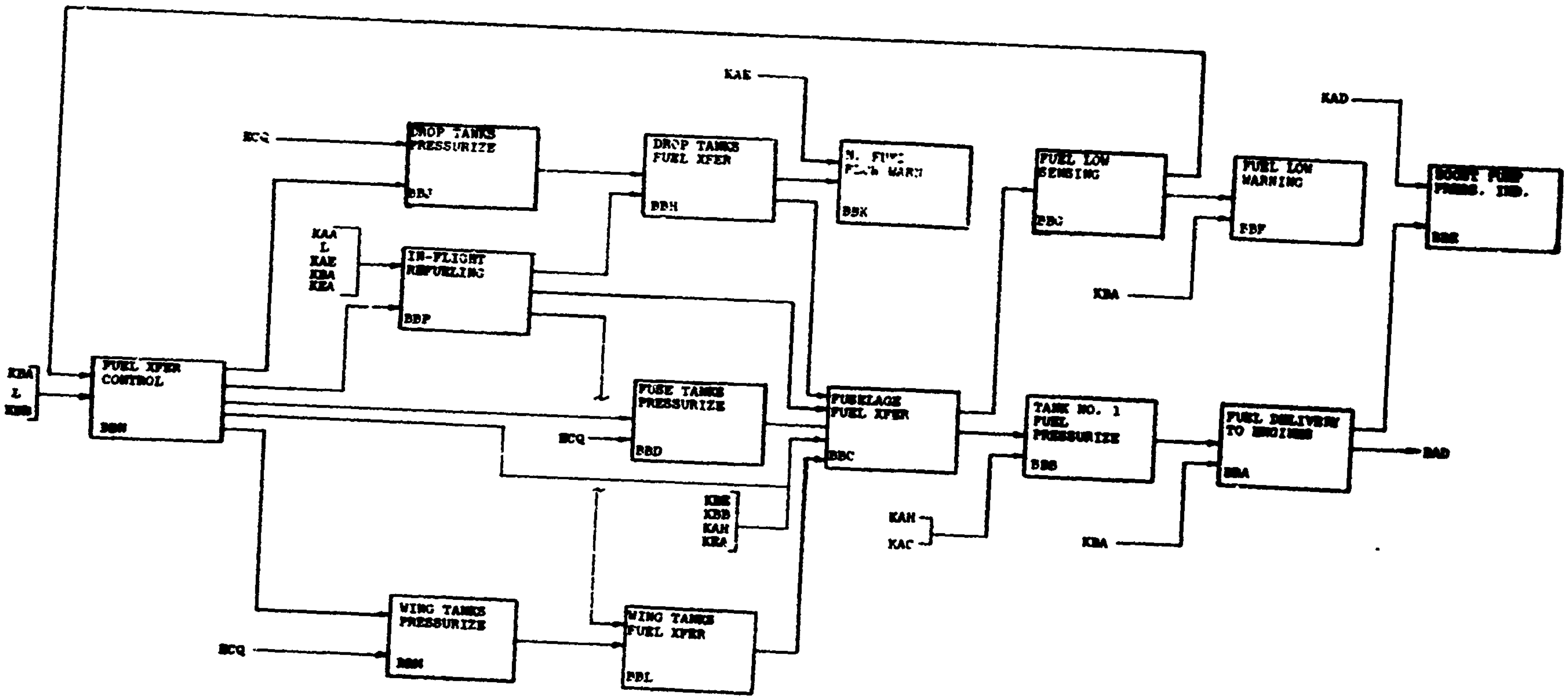
Date: 23 Apr 1969

Section 3-1.4



Aircraft: F-4J	
Title: Functional Diagram ENGINE & AFTERBURNER FUEL	
Document: NAVAIR 01-245FDB-2-3.1	**rev. date** 1 May 1968
Date: 23 Apr 1969	

Section B-1.5



Aircraft: F-4J

Title: Functional Diagram
FUEL SUPPLY

Document: NAVAIR 01-245FDB-2-3.3

rev. date 15 Jun 1968

Date: 23 Apr 1969

Section 3-Q

PROPULSION

	TITLE	WUC	ALPHA	INPUT	DEP FUNC	CD FC	AL FN	SENSITIVITY W 1 2 3 4 5 6 7 8 9
	PROPULSION		B	RBA				0AAAAAAA0
			B	LBA				0AAAAAAA0
	BASIC ENGINE NIGHT		RBA	RBAA	B			095555430
			RBA	RBAN				
	ENGINE AIR INDUCTION	3	RBAH	RBAJ	RBFC			AAAAAAAAA
		3	RBAH	RBDA	RBAG			AAAAAAAAA
		3	RBAH	RBFA	RBADB			AAAAAAAAA
		3	RBAH	RBEA	RBEE			AAAAAAAAA
	FRONT FRAME INLET CASE	323A1100	RBAHA				A	
	COMPRESSION	3	RBAG	RBAS	RBADB			AAAAAAAAA
		3	RBAG	RBAH	BAH			AAAAAAAAA
		3	RBAG		RBAC			AAAAAAAAA
		3	RBAG		RBABC			AAAAAAAAA
		3	RBAG		RBARA			AAAAAAAAA
16	BEARING NO 1	323A1110	RBAGA				A	
17	AIR/OIL CARBON SEAL	323A1120	RBAGB				5	
18	COMPRESSOR HOUSING	323A1200	RBAGC				A	
19	COMPRESSOR STATOR VANE	323A1210	RBAGD				7	
20	STATOR VANE SHROUD	323A1211	RBAGE				A	
21	COMPRESSOR ROTOR ASSEMBLY	323A1300	RBAGF				A	
22	COMPRESSOR REAR FRAME	323A1400	RBAGG				A	
23	BEARING NO 2	323A1410	RBAGH				A	
24	CARBON OIL SEAL	323A1420	RBAGJ				5	
25	CUPPORT	323A1440	RBAGK				A	
26	SHIELD	323A1450	RBAGL				A	
	ENGINE COMBUSTION	3	RBAC	RBAG	RBAP			FAAAAAAAAA
		3	RBAC	RBAL	RBAE			FAAAAAAAAA
			RBAC		RFA			SAAAAAAAAA
29		3	RBAC	RBADD				
		3	RBAC	RBAEA				
31	OUTER CASE	323A21	RBACA				A	
32	COMBUSTION CHAMBER	323A2200	RBACB				A	
33	INNER COMBUSTION CASING	323A23	RBACC				A	
34	TRANSITION DUCT	323A24	RBACD				A	
	COMPRESSOR ROTATION		RBAS	RBAF	RBAK			FAAAAAAAAA
	TURBINE ROTATION	3	RBAF	RBAC	RBAA			AAAAAAAAA
			RBAS	RBCA	RBAG			AAAAAAAAA
	TURBINE ROTATION		RBAF	RBCA	RBAS			AAAAAAAAA
36	FIRST STAGE TURBINE	323A31	RBAFA				A	
37	SECOND STAGE TURBINE	323A32	RBAFB				A	
38	THIRD STAGE TURBINE	323A33	RBAFC				A	
39	TURBINE ROTOR	323A3400	RBAFD				A	
40	INNER AIR BAFFLE	323A3420	RBAFE				A	
41	INTERSTAGE SEAL	323A3440	RBAFF				5	
42	TURBINE SHAFT	323A3450	RBAFG				A	
43	TURBINE CASING	323A3500	RBAFH				A	
44	TURBINE ROTOR SHROUD	323A3510	RBAFJ				A	
45	IMPINGEMENT MANIFOLD	323A3520	RBAFK				A	
46	TURBINE FRAME	323A3600	RBAFL				A	
47	VANE	323A3620	RBAFM				A	
48	INNER/OUTER CONE	323A3630	RBAFN				A	
49	SUPPORT	323A3640	RBAFP				A	
50	COOLING BAFFLE	323A3650	RBAFQ				6	
51	FRAME CONE SUPPORT	323A3660	RBAFR				A	
52	ROTOR SPILL BAFFLE	323A3670	RBAFS				7	
53	BEARING NO 3	323A3680	RBAFT				A	
54	CARBON OIL SEAL	323A3690	RBAFU				5	
	MAIN ENGINE THRUST	3	RBAA	RBAB	RBA			AAAAAAAAA
	MAIN ENGINE THRUST		RBAA	RBAF				
56	INNER REAR CONE	323A41	RBAAA				A	
57	FORWARD EXHAUST DUCT	323A4300	RBAAB				A	
58	LINER	323A4310	RBAAC				A	
59	CONE	323A4341	RBAAD				A	
60	REAR EXHAUST DUCT	323A4400	RBAAE				A	
61	LINER	323A4310	RBAAF				A	
62	OUTER SHELL	323A4420	RBAAG				A	
	ACCESSORY DRIVE	3	RBAK	RBAL	RBAE()			AAAAAAAAA
		3	RBAK	RBAS	RBCD			AAAAAAAAA
		3	RBAK		RBAD(			AAAAAAAAA
		3	RBAK		RUB			AAAAAAAAA
		3	RBAK		KEB			AAAAAAAAA
		3	RBAK		RKAU			AAAAAAAAA
		3	RBAK		RHAAA			AAAAAAAAA
	ACCESSORY DRIVE		RBAK		RBAJB			AAAAAAAAA
			RBAK		RBADB			AAAAAAAAA
			RBAK		RBAOC			AAAAAAAAA
71	FRONT GEARBOX	323A51	RBAKA				A	
72	TRANSFER GEARBOX	323A5200	RBAKB				A	
73	RADIAL DRIVE SHAFT	323A5210	RBAKC				A	
74	DRIVE SHAFT HOUSING	323A5220	RBAKD				A	

75 REAR GEARBOX	323A53	RBAKE				A	
75 BEARING HOUSING	323A54	RBAKF				A	
A/B COMBUSTION	3	RBAP	RBABA	RBABC			AAAAAAAAA
	3	RBAP	RBARA	RBAN			AAAAAAAAA
A/B COMBUSTION		RBAP	RBAC				
REAR EXHAUST DUCT	323A4400	RBAAE				A	
LINER	323A4310	RBAAF				A	
OUTER SHELL	323A4420	RBAAG				A	
AFTERBURNER THRUST	3	RBAN	RBAB	RBA			020000000
A/B THRUST		RBAN	RBAP				
ENGINE BLEED AIR	3	BAN	RBAG	CDA			AAAAAAAAA
	3	BAN	LBAG	EBAD			AAAAAAAAA
	3	BAN		F			AAAAAAAAA
	3	BAN		EAAJ			AAAAAAAAA
22 DUCTING	041231	EHA				A	
23 THERMAL COMPENSATOR	041234	EHB				A	
24 TOTAL TEMP COMPENSATOR	041235	EHC				A	
25 CHECK VALVE	041236	EHD				A	
26 RATIO BLEED CONTROLLER	041238	EHE				A	
86*INLET GUIDE VANE POSITION	3	RBAJ	RBAJA	RBADB			0A1111110
INLET GUIDE VANE POSITION		RBAJ		RBAJB			AAAAAAAAA
	3	RBAJ		RBAH			999999999
INLET GUIDE VANE ACTUATION	3	RBAJA	RBAJB	RBAJ			AAAAAAAAA
89 GUIDE VANE SUPPORT	323A1130	RBAJAA				A	
90 GUIDE VANE	323A1140	RBAJAB				A	
91 GUIDE VANE BEARING	323A1150	RBAJAC				A	
92 HALF RING ASSEMBLY LH	323A1160	RBAJAD				5	
93 LEVER ARM	323A1161	RBAJAE				A	
94 BELLCRCANK SUPPORT	323A1220	RBAJAF				A	
95 MAIN CRANK	323A1230	RBAJAG				A	
96 MASTER ROD	323A1240	RBAJAH				A	
97 LH ACTAUTOR	323A118*	RBAJAJ				5	
98 RH ACTUATOR	323A11**	RBAJAK				5	
99 HALF RING ASSEMBLY RH	323A1160	RBAJAL				5	
VANE CONTROL	3	RBAJB	RBAJ	RBAJA			AAAAAAAAA
A1	3	RBAJB	RBAH	RBABC			AAAAAAAAA
A2	3	RBAJB	RBAK				
VANE CONTROL		RBAJB	RBADB				
		RBAJB	RBADA				
A4 FEEDBACK SIGNAL SHAFT	323A11**	RBAJBA				A	
ENGINE COOLING AIR		RBAL	RBEA	RBAC			AAAAAAAAA
		RBAL	RBFA	RBAK			FAAAAAAAAA
*AUX AIR DOOR POSITION	3	RBEA	RBEC	RBAH			521111125
	3	RBEA		RBEB			AAAAAAAAA
	3	RBEA		RBAL			AAAAAAAAA
A8 AUXILLIARY AIR DOOR	311331	RBEAA				A	
AUX AIR DOOR ACTATION	3	RBEC	RBED	RBEA			AAAAAAAAA
A9	3	RBEC	KEA				
B0 AUX AIR DOOR ACTUATOR	311332	RBECA				A	
AUX AIR DOOR CONTROL	3	RBED	RBEF	RBEC			AAAAAAAAA
AUX AIR DOOR SELECTOR VALVE	311334	RBEDA				A	
PILOT MODE SELECT	3	RBEF	L	RBED			AAAAAAAAA
B4	3	RBEF	KAB				
B5 AUX AIR DOOR RELAY	31133*	RBEFA				A	
B6 LANDING GEAR HANDLE SWITCH	313112	DADB		RBEF		A	
B7 5 AMP CIRCUIT BREAKER	31133*	DADA		RBEF		A	
DOOR POSITION INDICATION	3	RBEB	RBEA	H			500000009
B9	3	RBEB	KAE				
WARNING LIGHT	311333	RBEBA				A	
AUX LANDING GEAR RELAY	31311*	DADC		RBEB		A	
AUX AIR DOOR POSITION SW	31133*	RBEBB				A	
C3*BELLMOUTH POSITION	3	RBFA	RBFB	RBAL			0A1111100
	3	RBFA		RBAH			131111131
C5 BELLMOUTH RING	329A11	RBFAA				A	
BELLMOUTH ACTUATION	3	RBFB	RBFC	RBFA			AAAAAAAAA
C7 ACTUATOR	329A12	RBFBA				A	
C8 CABLE	329A13	RBFBB				A	
C9 PULLEY	329A14	RBFBC				A	
D3 SECTOR	329A15	RBFBD				A	
D1 IDLER*ROD* AND BELLCRANK	329A1F	RBFBE				A	
SENSING AND CONTROL	3	RBFC	CF	RBFB			AAAAAAAAA
D3	3	RBFC	KEA				
SENSING AND CONTROL		RBFC	RBAH				
D4 CONTROLLER	329A16	RBFCA				A	
D5 PITOT TUBE	329A1H	RBFCD				A	
D6 STATIC SENSOR	329A1*	RBFCE				A	
*VARIABLE RAMPS POSITION	3	BDA	BDB	RBAH	F		011111110
VARIABLE RAMPS POSITION	3	BDA	BDB	LBAH			011111110
	3	BDA		BDD			AAAAAAAAA
D9 FORWARD RAMP	311311	BDAA				A	

29508

E0 AFT RAMP	311312	BOAB				A	
E1 FIXED RAMP	311313	BOAC				A	
VARIABLE RAMPS ACTUATION	3	BOB	BDC	BDA			AAAAAAAAA
E3 RAMP MECHANISM ROD	311315	BOBA				A	
E4 RAMP ACTUATOR	311314	BOBB				A	
E5 RAMP HINGE	311316	BOBC				A	
E6 RAMP SWIVEL	311317	BOBD				A	
E7 BELLCRANK	31131F	BOBE				A	
RAMPS CONTROL	3	BDC	KEA	BDB			AAAAAAAAA
E9	3	BDC	BDD				
E9	3	BDC	KAA				
F0 SERVO VALVE	31131A	BDCA				A	
F1 RAMP CONTROL AMPLIFIER	31131E	BDCB				A	
SIGNAL SENSING	3	BDD	BDA	BDC			AAAAAAAAA
	3	BDD	CF				
F4 FEEDBACK POTENTIOMETER	31131D	BDDA				A	
INLET AIR TEMP HIGH WARNING	3	RBEE	KAE	H			AAAAAAAAA
	3	RBEE	RBAH				
TEMP SENSOR	31131*	RBEEA				A	
5 AMP FUSE	31131*	RBEEB				A	
WARNING LIGHT	31131*	RBEEC				A	
G1*MAIN FUEL DELIVERY	3	RBADD	RBADC	RBAC			0A5555430
	3	RBADD		RBARA			AAAAAAAAA
MAIN FUEL DELIVERY		RBADD		RBCB			FAAAAAAAAA
		RBADD		RBAGA			F555555555
G3 PRIMARY FUEL NOZZLE	323A68	RBADDA				A	
G4 SECONDARY FUEL NOZZLE	323A68	RBADDB				A	
G5 FUEL TUBING	323A67	RBADDC				A	
PRESSUREIZE AND DRAIN	3	RBADC	RBADB	RBADD			AAAAAAAAA
G7 PRESSURIZE AND DUMP VALVE	323A65	RBADCA				A	
FUEL REGULATION AND CONTROL	3	RBADB	RBAJ	RBAJB			FAAAAAAAAA
	3	RBADB	RBADA	RBARB			FAAAAAAAAA
REGULATION AND CONTROL		RBADB	RBAG	RBADE			AAAAAAAAA
		RBADB	RBAH	RBADC			AAAAAAAAA
		RBADB	RBAK	RBAG9			FAAAAAAAAA
		RBADB	RBAB				
		RBADB	BGAB				
		RBADB	KBA				
		RBADB	L				
H1 MAIN FUEL CONTROL	323A6200	RBADBA				A	
H2 TORQUE BOOSTER CONTROL	323A63	RBADBB				A	
H3 FUEL OIL COOLER	323A64	RBCBB				A	
5 AMP FUSE	323A62**	RBADBC				A	
INLET TEMPERATURE SENSOR	323A6210	RBADBD				A	
H6 THROTTLE LEVER	329311	RBGAAA				A	
H6 FUEL FLOW TRANSMITTER	351442	RBADEA				A	
FUEL FLOW INDICATION	3	RBADE	RBADB	H			AAAAAAAAA
J8	3	RBADE	KAD				
FUEL FLOW TRANSMITTER	351442	RBADEA				A	
FUEL FLOW INDICATOR	351441	RBADEB				A	
5 AMP FUSE	35144*	RBADEC				A	
FUEL SUPPLY PRESSURIZE	3	RBADA	RBAK	RBADB			AAAAAAAAA
J4 MAIN FUEL PUMP	323A6100	RBADAA				A	
		RBADA	RBBA	RBAJB			
J5 BYPASS INDICATOR SWITCH	323A6110	RBADAB				1	
FUEL FILTER	323A610*	RBADAC				A	
TEMPERATURE AMPLIFIER	323A93	RBABCB				A	
A/B FUEL DELIVERY	3	RBAQA	RBAQB	RBAP			AAAAAAAAA
A/B FUEL DISTRIBUTION		RBAQA	RBADD	RBCB			F555555555
		RBAQA		RBARA			AAAAAAAAA
A/B FUEL SPRAYBAR	323A74	RBAQAA				A	
A/B FUEL MANIFOLD	323A75	RBAQAB				A	
FUEL OIL COOLER	323A72	RBCBC				A	
TUBING	323A77	RBAQAC				A	
PRESSURIZING VALVE	323A73	RBAQAD				A	
A/B FUEL REGULATION	3	RBAQB	RBADB	RBAQA			AAAAAAAAA
	3	RBAQB	RBAQC				
	3	RBAQB	RBAG				
	3	RBAQB	L				
A/B FUEL CONTROL	323A78	RBAQBA				A	
THROTTLE LEVER	329311	RBGAAA				A	
A/B FUEL PRESSURIZE	3	RBAQC	RBAK	RBAQB			AAAAAAAAA
K9	3	LBAQC	RBBA				
A/B FUEL PUMP	323A7100	RBAQCA				A	
CHECK VALVE	323A7110	RBAQCB				A	
FILTER	323A710*	RBAQCC				A	
PUMP VENT VALVE	323A7120	RBAQCD				A	
FUEL INLET VALVE	323A7130	RBAQCE				A	
ON/OFF VALVE	323A7140	RBAQCF				A	
L6 ENGINE IGNITION	3	RBAEA	RBADD	RBAC	T		00AAAAA00

L7		3	RBAEA	RBAEB		
L8	IGNITER PLUG	323AA*	RBAEAA			A
L9	HIGH TENSION LEAD	323AA5	RBAEAB			A
	IGNITION GENERATION	3	RBAEB	RBAEC	RBAEA	AAAAAAAAA
		3	RBAEB	RBARB	RBARA	FAAAAAAAAA
		3	RBAEB		RBAB	AAAAAAAAA
M2	IGNITION EXCITER UNIT	323AA1	RBAEBA			A
	MODE SELECT	3	RBAEC	L	RBAEB	AAAAAAAAA
M4		3	RBAEC	KAC		
M5	THROTTLE SWITCH	323AA*	RBAECA			A
M6	5 AMP FUSE	323AA*	RBAECB			A
	*AFTERBURNER IGNITION	3	RBARA	RBAEB	RBAP	AAAAAAAAA
M8		3	RBARA	RBAQA		
M9		3	RBARA	RBAG		
	A/B IGNITION		RBARA	RBADD		
N0	TORCH IGNITER	323A4340	RBARAA			A
N1	IGNITER PLUG	323A434*	RBARAB			A
	AFTERBURNER IGNITION CONT	3	RBARB	RBARC	RBAEB	AAAAAAAAA
		3	RBARB	RBADB	RBABC	AAAAAAAAA
N7	AFTERBURNER IGNITION SWITCH	323AA4	RBARBA			A
N8	HYD XFER PUMP CONTROL RELAY	323AA*	RBARBB			A
	AFTERBURNER MODE SELECT	3	RBARC	L	RBARB	AAAAAAAAA
P0		3	RBARC	KAH		
P1	THROTTLE LEVER	329311	RBGAAA			A
P2	5 AMP FUSE	323AA*	RBARCA			A
	EXAUST NOZZLE POSITION	3	RBAB	RBABB	RBABA	AAAAAAAAA
		3	RBAB	RBAEB	RBAN	F999999999
		3	RBAB		RBAA	F888888888
	NOZZLE POSITION		RBAB		RBADB	AAAAAAAAA
			RBAB		RBA	SAAAAAAAAA
	NOZZLE POSITION INDICATION	3	RBABA	KBA	H	011111110
		3	RBABA	RBAB		
	5 AMP FUSE	35163*	RBABAA			A
	NOZZLE POSITION INDICATOR	351637	RBABAB			A
	NOZZLE ACTUATION	3	RBABB	RBABC	RBAB	AAAAAAAAA
		3	RBABB	RBABD	RBCE	AAAAAAAAA
Q0	OUTER SHROUD	323A4460	RBABBA			B
Q1	SUPPORT RING	323A4470	RBABBB			A
Q2	SHROUD FLAP	323A4471	RBABBC			A
Q3	SHROUD FLAP SEAL	323A4472	RBABBD			2
Q4	NOZZLE FLAP	323A4480	RBABBE			A
Q5	NOZZLE FLAP SEAL	323A4481	RBABBF			5
Q6	NOZZLE FLAP HINGE	323A4482	RBABBG			A
	CAM LINK ACTUATOR	323A4490	RBABBH			A
Q8	ACTUATOR	323A4440	RBABBJ			4
Q9	ACTUATOR	323A4440	RBABBK			4
R0	ACTUATOR	323A4440	RBABBL			4
R1	ACTUATOR	323A4440	RBABBM			4
R2	ROD	323A4450	RBABBN			4
R3	ROD	323A4450	RBABBP			4
R4	ROD	323A4450	RBABBQ			4
R5	ROD	323A4450	RBABBR			4
R6	NOZZLE AREA CONTROL VALVE	323A6A	RBABBS			A
R7	FEEDBACK CABLE	323A4***	RBABBT			A
	PRESSURE GENERATION	3	RBABD	RBCD	RBABB	AAAAAAAAA
R9		3	RBABD	RBAK		
		3	RBABD	RBCF		
S0	NOZZLE PUMP	323A88	RBABDA			A
	SIGNAL SENSING	3	RBABC	RHABB	RBABB	AAAAAAAAA
		3	RBABC	RBAJB		
S2		3	RBABC	RBARB		
S2		3	RBABC	RBAG		
S2		3	RBABC	RBAP		
		3	RBABC	CF		
S3	CONTROL ALTERNATOR	323A92	RBABCA			A
S4	TEMPERATURE AMPLIFIER	323A93	RBABCB			A
	EXHAUST GAS THERMOCOUPLE	351424	RBABCC			A
S6	BRANCHED CABLE	323A91	RBABCD			A
	*FUEL CONTROL SETTING	3	BGAB	BGAA	BGBA	000000050
		3	BGAB	KBE	RBADB	AAAAAAAAA
		3	BGAB	KBE	LBADB	AAAAAAAAA
S8		3	BGAB	BGBA		
S9	INTEGRATED TORQUE BOOSTER	329C15	BGABA			A
	POWER SELECTION	3	BGAA	L	BGAB	AAAAAAAAA
T1	THROTTLE LEVER	329311	BGAAA			A
	FRICTION LOCK	329312	BGAAB			5
T3	TELEFLEX UNIT	32931D	BGAAC			A
T4	TELESCOPING UNIT	32931E	BGAAD			A
T5	ROD	329316	BGAAE			A
T6	*APCS ACTIVATION	3	BGBA	KBE	BGAB	000000010

T7		3	B0BA	B0AB			
T7		3	B0BA	B0BB			
T7		3	B0BA	KAA			
T8	CONTROL AMPLIFIER	329C14	B0BAA			A	
	SIGNAL CONDITIONING	3	B0BB	B0BD	B0BA		AAAAAAAAA
		3	B0BB	KAA	B0BC		AAAAAAAAA
U0		3	B0BB	KBE			
U1	THROTTLE CONTROL COMPUTER	329C1*	B0BBA			A	
	SIGNAL SENSING	3	B0BD	B0BE	B0BB		AAAAAAAAA
U3		3	B0BD	KBE			
	SIGNAL SENSING		B0BD	CF			
U4	ACCELEROMETER	329C1*	B0BDA			A	
U5	ANGLE OF ATTACK TRANSMITTER	329C11	B0BDB			A	
U6	STAB POSITION TRANSDUCER	329C11	B0BDC			A	
	MODE SELECT	3	B0BE	L	B0BD		AAAAAAAAA
U8	APCS SELECT SWITCH	329C1*	B0BEA			A	
U9	5 AMP CIRCUIT BREAKER	329C1*	B0BEB			A	
V0	5 AMP CIRCUIT BREAKER	329C1*	B0BEC			A	
V0	5 AMP CIRCUIT BREAKER	329C1*	B0BED			A	
V0	5 AMP CIRCUIT BREAKER	329C1*	B0BEE			A	
V0	5 AMP CIRCUIT BREAKER	329C1*	B0BEF			A	
V1	AIR TEMP SWITCH	329C1A	B0BEG			A	
V2	ENGINE SELECTOR SWITCH	329C1*	B0BEH			A	
V3	EMERG SPEED BRAKE SWITCH	31462A	CEFA			A	
V4	SPEED BRAKE CONTROL SWITCH	314627	CEDA			A	
V5	NLG DOWN LIMIT SWITCH	313143	DAABAA			A	
V6	R MAIN GEAR SCISSOR SWITCH	313145	RDAAAA0			A	
V7	SPEED BRAKE RETRACT RELAY	31462*	CEEA			A	
V8	APCS DISENGAGE RELAY	329C1*	B0BEJ			A	
V9	POWER INTERLOCK RELAY	329C1*	B0BEK			A	
	APCS OFF INDICATION	3	B0BC	B0BB	H		000000080
W1		3	B0BC	KAE			
W2	WARNING LIGHT	329C17	B0BCA			A	
W3	WARNING LIGHT RELAY	329C1*	B0BC9			A	
	FUEL/HYDRAULIC RADIATOR	445128	KCDC			A	
06*	FUEL DELIVERY TO RH ENGINE	4	RBBA	KBA	RBADA		0A5555530
		4	RBBA	BBB			
	FUEL DELIVERY TO ENGINES		RBBA		RBA0C		AAAAAAAAA
	STRAINER/DRAIN VALVE	446136	RBBAA			A	
	FUEL/HYDRAULIC RADIATOR	445128	KDDC			A	
	MAINFOLD SHUTOFF VALVE	446136	RBBAB			A	
	ENGINE FEED MANIFOLD	446137	RBBAC			A	
	TANK NO 1 FUEL PRESSURIZE	4	BBB	BBC	RBBA		F011123440
	TANK NO 1 FUEL PRESSURIZE	4	BBB	KAH	LBBA		F011123440
13		4	BBB	KAC	BBE		AAAAAAAAA
			BBB		B		SAAAAAAAAA
	LH BOOST PUMP ASSEMBLY	44613100	BBBA			5	
	RH BOOST PUMP ASSEMBLY	44613100	BBBB			5	
17	RH PUMP CHECK VALVE	446133	RBBBC			1	
18	BOOST PUMP BYPASS CHECK V	44613*	BBBD			A	
19	DEFUELING SHUTOFF VALVE	446122	BBBE			A	
20	TANK NO 1 DRAIN VALVE	44613*	BBBF			A	
21	MANIFOLD DRAIN VALVE	446135	BBBG			A	
	FUSELAGE FUEL TRANSFER	4	BBC	KBE	BBB		AAAAAAAAA
		4	BBC	BBL	BBG		AAAAAAAAA
24		4	BBC	KAH			
25		4	BBC	KEA			
26		4	BBC	BBD			
27		4	BBC	KBB			
28		4	BBC	BBH			
29		4	BBC	BBN			
29		4	BBC	BBP			
30	TANK NO 1	446161	BBCA			A	
31	TANK NO 2	446162	BBCB			A	
32	TANK NO 3	446163	BBCC			A	
33	TANK NO 4	446164	BBCD			A	
34	TANK NO 5	446165	BBCE			A	
35	TANK NO 6	446166	BBCF			A	
36	TANK NO 7	446167	BBCG			A	
37	INTERCONNECT CHECK VALVE	446145	BBCH			2	
38	INTERCONNECT CHECK VALVE	446145	BBCJ			2	
39	INTERCONNECT CHECK VALVE	446145	BBCK			2	
40	TANK NO 4 HYD FUEL PUMP	44614A	BBCL			2	
41	TANK NO 4 ELECT FUEL PUMP	44614D	BBCM			2	
42	TANK NO 6 HYD FUEL PUMP	44614B	BBCN			2	
43	TANK NO 6 ELECT FUEL PUMP	44614E	BBCP			2	
44	NO 1 FUEL LEVEL CONTROL V	446148	BBCQ			2	
45	NO 2 FUEL LEVEL CONTROL V	446142	BBCR			2	
46	NO 7 FUEL XFER SHUTOFF V	44614*	BBCS			1	

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47	NO 7 XFER MANUAL CONTROL V	446140	BBCT			1	
	FUSELAGE TANKS PRESSURIZE	4	BBD	BBN	BBC		222222222
49		4	BBD	ECQ			
	HOT AIR CHECK VALVE	446116	BBDA			A	
	AIRFLOW LIMITER	446118	BBDB			A	
	PRESSURE REGULATOR	446111	BBDC			A	
	FUSELAGE HOT AIR CHECK V	446116	BBDD			A	
	PRESSURE/VACUUM VALVE	446113	BBDE			A	
	DIVE VENT CHECK VALVE	446115	BBDF			A	
	DIVE VENT CHECK VALVE	446115	BBDG			A	
	DIVE VENT CHECK VALVE	446115	BBDH			A	
	TANK NO 7 PILOT VALVE	44611*	BBDJ			A	
	TANK NO 7 PRESS REGULTOR	44611*	BBDK			A	
	CHECK VALVE	44611*	BBDL			A	
	CHECK VALVE	44611*	BBDM			A	
	CHECK VALVE	44611*	BBDN			A	
	CHECK VALVE	44611*	BBDP			A	
	CHECK VALVE	44611*	BBDQ			A	
	CHECK VALVE	44611*	BBDR			A	
	VENT MAST FIRE SCREEN	44611*	BBDS			A	
	FIRE SCREEN DRAIN	44611*	BBDT			A	
	DROP TANKS FUEL TRANSFER	4	BBH	BBJ	BBC		000000000
69		4	BBH	BBP	BBK		AAAAAAAAA
	CL TANK EMERG RELIEF VALVE	44621*	BBHA			A	
	CL TANK FWD DRAIN VALVE	44621*	BBHB			A	
	CL TANK AFT DRAIN VALVE	44621*	BBHC			A	
	CL TANK FUEL DISCONNECT	446218	BBHD			A	
	CL TANK FUEL CONTROL VALVE	446223	BBHE			A	
	CL TANK PILOT VALVE	446221	BBHF			A	
	CL TANK FUEL SHUTOFF VALVE	446225	BBHG			A	
	REFUELING SHUTOFF VALVE	446121	BBHH			A	
	R DROP TANK PILOT VALVE	446222	RBBHJ			A	
	R DROP TANK FUEL CONTROL V	446224	RBBHK			A	
	R DROP TANK FUEL DISCONNECT	44623*	RBBHL			A	
	R DROP TANK FUEL SHUTOFF V	446226	RBBHM			A	
	CL DROP TANK	446231	BBHN			A	
	R DROP TANK	446233	RBBHP			A	
	DROP TANKS PRESSURIZE	4	BBJ	BBN	BBH		AAAAAAAAA
90		4	BBJ	ECQ			
	CL TANK PRESSURE REGULATOR	446211	BBJA			A	
	CL TANK PRESS/VENT VALVE	446212	BBJB			A	
	CL TANK HOT AIR CHECK VALVE	446217	BBJC			A	
	CL TANK AIR DISCONNECT	446214	BBJD			A	
	CL TANK PRESS CHECK FITTING	44621C	BBJE			A	
	R DROP TANK AIR DISCONNECT	44621B	RBBJF			A	
	R DROP TANK PRESS/VENT V	44621D	RBBJG			A	
	R DROP TANK PRESS REGULATOR	446215	RBBJH			A	
	RH HOT AIR CHECK VALVE	446216	RBBJJ			A	
	R PRESSURE CHECK FITTING	44621C	RBBJK			A	
	NO FUEL FLOW WARNING	4	BBK	BBH	H		001100000
A7		4	BBK	KAE			
	CL TANK FUEL FLOW SWITCH	446227	BBKA			A	
	R FUEL FLOW SWITCH	44622A	RBBKB			A	
	5 AMP FUSE	44622*	BBKC			A	
	WARNING LIGHT	44643*	BBKD			A	
	WING TANKS FUEL TRANSFER	4	BBL	BBP	BBC		000011100
84		4	BBL	BBM			
	R WING I/B LEVEL SHUTOFF V	44617B	RBBLA			A	
	R WING O/B LEVEL SHUTOFF V	44617B	RBBLB			A	
	R WING TANK	446172	RBBLC			A	
	WING TANKS PRESSURIZE	4	BBM	BBN	BBL		AAAAAAAAA
C2		4	BBM	ECQ			
	R WING TANK PRESS REGULATOR	446112	RBBMA			A	
	R HOT AIR CHECK VALVE	446116	RBBMB			A	
	R WING PRESS CHECK FITTING	44611?	RBBMC			A	
	R WING PRESS/VENT VALVE	446118	RBBMD			A	
	EXTERNAL AIR PRESS CONNECT	44611*	BBME			A	
	R WING TANK DRAIN VALVE	44611A	RBBMF			A	
	FUEL TRANSFER CONTROL	4	BBN	L	BBJ		FAAAAAAAAA
		4	BBN	KBA	BBP		FAAAAAAAAA
		4	BBN	KBB	BBC		AAAAAAAAA
		4	BBN	BBG	BBD		FAAAAAAAAA
		4	BBN		BBM		FAAAAAAAAA
	TANK NO 6 HYD PUMP PRESS SW	446146	BBNA			A	
	TANK NO 4 HYD PUMP PRESS SW	446146	BBNB			A	
	ELECT XFER PUMP PRESS SW	446157	BBNC			A	
	TANK NO 5 LEVEL CONT VALVE	446144	BBND			A	
	TANK NO 3 LEVEL CONT VALVE	446143	BBNE			A	
	TANK NO 1 LEVEL CONT VALVE	446148	BBCQ			A	

E6	R ENGINE MASTER SWITCH	423A9*	RBBNB				A	
	REFUEL PROBE SWITCH	44631A	BBNH				A	
	WING XFER PRESS SWITCH	44611*	BBNJ				A	
	DROP TANKS SELECTOR SWITCH	446417	BBNK				A	
	FUEL LEVEL CONT MASTER SW	44641*	BBNL				A	
	REFUEL SELECTOR SWITCH	446417	BBNM				A	
	WING TANKS XFER SWITCH	44641*	BBNN				A	
	LANDING GEAR HANDLE SWITCH	413112	DADB				A	
	R MAIN GEAR DOWN LIMIT SW	413142	RDAAAAC				A	
	R MAIN GEAR SCISSORS SWITCH	413145	RDAAAAG				A	
	FUEL LOW LEVEL SWITCH	446431	BBNG				A	
	TRANS PRESS SEQUENCE RELAY	44611*	BBNR				A	
	AUTO TRANSFER RELAY	44641*	BBNS				A	
	WING/DROP TANKS PRESS RELAY	44611*	BBNT				A	
	REFUEL RELAY	44612*	BBNU				A	
	DROP TANK PRESS RELAY	44621*	BBNV				A	
	DROP TANK SELECTOR RELAY	44621*	BBNW				A	
	CL TANK PRESS RELAY	44611*	BBNX				A	
	CL TANK SELECTOR RELAY	44621*	BBNY				A	
	WING TANK STOP XFER RELAY	44615*	BBNZ				A	
	5 AMP FUSE	44641*	BBQA				A	
	5 AMP FUSE	44641*	BBQB				A	
	5 AMP FUSE	44641*	BBQC				A	
	5 AMP FUSE	44641*	BBQD				A	
	5 AMP FUSE	44641*	BBQE				A	
	5 AMP FUSE	44641*	BBQF				A	
	FUEL LOW SENSING	4	BBG	BBC	BBF			AAAAAAAAA
		4	BBG		BBN			AAAAAAAAA
	TANK NO 5 LEVEL CHECK SW	44642*	BBGF				A	
	FUEL LOW LEVEL SWITCH	446432	BBGG				A	
	FUEL LOW WARNING	4	BBF	BBG	H			000001100
H6		4	BBF	KBA				
	WARNING LIGHT	446433	BBFA				A	
	5 AMP FUSE	44643*	BBFB				A	
	FUEL LOW INDICATOR	451847	BBFC				A	
	BOOST PUMP PRESS INDICATION	4	BBE	KAD	H			061111110
		4	BBE	BBB				
	R PRESSURE TRANSMITTER	451845	RBBEA				A	
	R PRESSURE INDICATOR	451846	RBBEB				A	
	5 AMP FUSE	44642*	BBEC				A	
J7	IN-FLIGHT REFUELING	4	BBP	L	BBH	R		000AAAA70
		4	BBP	KAA	BBC			000AAAA70
		4	BBP	KAE	BBL			000AAAA70
K0		4	BBP	KBA				
K1		4	BBP	KEA				
	IN FLIGHT REFUELING		BBP	BBN	BBR			111111111
	R WING TANK LEVEL CONTROL V	446153	RBBPA				A	
	AIR REFUELING PROBE ASSY	44631100	BBPB				A	
	PROBE CHECK VALVE	44631*	BBPL				A	
	PROBE DOOR LATCH ACTUATOR	446313	BBPC				A	
	PROBE DOOR ACTUATOR	446314	BBPD				A	
	PROBE CONTROL SWITCH	44631A	BBNH				A	
	PROBE DOOR	44631C	BBPE				A	
	SEQUENCE VALVE	44631*	BBPF				A	
	SELECTOR VALVE	446316	BBPG				A	
	PROBE UNLOCKED WARN LIGHT	446312	BBPH				A	
	5 AMP CIRCUIT BREAKER	44631*	BBPJ				A	
	5 AMP FUSE	44631*	BBPK				A	
	NIGHT REFUELING LIGHT	444228	BBPL				A	
	NO 1 FUEL LEVEL CONTROL V	446148	BBCQ				A	
	NO 2 FUEL LEVEL CONTROL V	446142	BBCR				A	
	NO 5 FUEL LEVEL CONTROL V	446144	BBDN				A	
	NO 3 FUEL LEVEL CONTROL V	446143	BBNE				A	
	R DROP TANK FEUL SHUTOFF V	446226	RBBHM				A	
	CL DROP TANK SHUTOFF VALVE	446225	BBHG				A	
	REFUELING SHUTOFF VALVE	446221	BBHM				A	
	R DROP TANK CONTROL VALVE	446224	RBBHK				A	
	CL DROP TANK CONTROL VALVE	446223	BBHE				A	
	REFUEL READY INDICATION	4	BBR	BBP	H	R		000111110
M8		4	BBR	KAE				
	REFUEL READY LIGHT	44631*	BBRA				A	
	5 AMP FUSE	44631*	BBRB				A	
	SWITCH	44631*	BBRC				A	
	*ENGINE OIL DISTRIBUTION	-	RBCA	RBCB	RBCF			0A5555520
	DISTRIBUTION		RBCA		RBAS			FAAAAAAAAA
			RBCA		RBAF			FAAAAAAAAA
			RBCA		RBA			SAAAAAAAAA
02	OIL NOZZLES	-23A8710	RBCAA				A	
03	OIL TUBING	-23A8700	RBCAB				A	
	OIL SCAVENGE	-	RBCF	RBCA	RBCE			AAAAAAAAA
	SCAVANGE		RBCF		RBABD			333333333

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06	NO 1 SCAVENGE PUMP	-23A82	RBCFA			A	
07	NO 2 SCAVENGE PUMP	-23A83	RBCFB			A	
08	NO 3 SCAVENGE PUMP	-23A84	RBCFC			A	
09	CSD FILTER	-42227	RBCFD			A	
10	VARIABLE NOZZLE FILTER	-23A**	RBCFE			2	
11	VARIABLE NOZZLE FILTER	-23A**	RBCFF			2	
12	CHECK VALVE	-23A**	RBCFG			A	
13	SCAVENGE OIL FILTER	-23A**	RBCFH			2	
	OIL SUPPLY	-	RBCE	RBABB	RBCH		AAAAAAAAA
		-	RBCE	RBCF	RBCD		AAAAAAAAA
		-	RBCE	RKAU	RKAU		AAAAAAAAA
17	OIL TANK	-23A8500	RBCEA			A	
18	PRESSURIZE/VACUUM VALVE	-23A8510	RBCEB			A	
19	CHECK VALVE	-23A85**	RBCEC			A	
	LOW LEVEL WARNING	-	RBCH	RBCE	H		022222220
21		-	RBCH	KAE			
	OIL LEVEL AMPLIFIER	-23A9*	RBCHA			A	
	LOW LEVEL WARNING LIGHT	-23A9*	RBCHB			A	
	OIL LEVEL SENSOR	-23A9*	RBCHC			A	
	5 AMP FUSE	-23A9*	RBCHD			A	
	PRESSURE GENERATION	-	RBCD	RBCE	RBCG		AAAAAAAAA
		-	RBCD	RBAK	RBABD		084444430
		-	RBCD		RBCC		AAAAAAAAA
29	MAIN OIL PUMP	-23A81	RBCDA			A	
	OIL PRESSURE INDICATION	-	RBCG	RBCD	H		999999999
31		-	RBCG	KAD			
	5 AMP FUSE	-23A9*	RBCGA			A	
	PRESSURE TRANSMITTER	-51434	RBCGB			A	
	PRESSURE INDICATOR	-51433	RBCGC			A	
	PRESSURE REGULATION	-	RBCC	RBCD	RBCB		AAAAAAAAA
36	RELIEF VALVE	-23A8*	RBCCA			A	
	TEMPERATURE CONTROL	-	RBCB	RBAQA	RBCA		AAAAAAAAA
		-	RBCB	RBADD	RBCJ		033333330
38		-	RBCB	RBCC			
39	AIR OIL COOLER	-23A8*	RBCBA			3	
40	MAIN FUEL OIL COOLER	-23A64	RBCBB			A	
41	AOB FUEL OIL COOLER	-23A72	RBCBC			1	
42	TEMPERATURE REGULATOR	-23A86	RBCBD			A	
	OIL TEMPERATURE INDICATION	-	RBCJ.	RBCB	H		033333330
	THERMOCOUPLE SENSOR	-51424	RBCJA			A	
	TEMPERATURE INDICATOR	-51425	RBCJB			A	
	BASIC ENGINE LEFT		LBA	LBAA	B		095555430
			LBA	LBAN			
	ENGINE AIR INDUCTION	3	LBAH	LBAJ	LBFC		AAAAAAAAA
		3	LBAH	LBDA	LBAG		AAAAAAAAA
		3	LBAH	LBFA	LBADB		AAAAAAAAA
		3	LBAH	LBEA	LBEE		AAAAAAAAA
	FRONT FRAME INLET CASE	323A1100	LBAHA			A	
	COMPRESSION	3	LBAG	LBAS	LBADB		AAAAAAAAA
		3	LBAG	LBAH	BAM		AAAAAAAAA
		3	LBAG		LBAC		AAAAAAAAA
		3	LBAG		LBABC		AAAAAAAAA
		3	LBAG		LBARA		AAAAAAAAA
	BEARING NO 1	323A1110	LBAGA			A	
	AIR/OIL CARBON SEAL	323A1120	LBAGB			5	
	COMPRESSOR HOUSING	323A1200	LBAGC			A	
	COMPRESSOR STATOR VANE	323A1210	LBAGD			7	
	STATOR VANE SHROUD	323A1211	LBAGE			A	
	COMPRESSOR ROTOR ASSEMBLY	323A1300	LBAGF			A	
	COMPRESSOR REAR FRAME	323A1400	LBAGG			A	
	BEARING NO 2	323A1410	LBAGH			A	
	CARBON OIL SEAL	323A1420	LBAGJ			5	
	CUPPORT	323A1440	LBAGK			A	
	SHIELD	323A1450	LBAGL			A	
	ENGINE COMBUSTION	3	LBAC	LBAG	LBAP		FAAAAAAAAA
		3	LBAC	LBAL	LBAF		FAAAAAAAAA
		3	LBAC	LBADD			
		3	LBAC	LBAEA			
			LBAC		LBA		SAAAAAAAAA
	OUTER CASE	323A21	LBACA			A	
	COMBUSTION CHAMBER	323A2200	LBACB			A	
	INNER COMBUSTION CASING	323A23	LBACC			A	
	TRANSITION DUCT	323A24	LBACD			A	
	COMPRESSOR ROTATION		LBAS	LBAF	LBAK		FAAAAAAAAA
			LBAS	LBCA	LBAG		AAAAAAAAA
	TURBINE ROTATION	3	LBAF	LBAC	LBAA		AAAAAAAAA
	TURBINE ROTATION		LBAF	LBCA	LBAS		AAAAAAAAA
36	FIRST STAGE TURBINE	323A31	LBAFA			A	
37	SECOND STAGE TURBINE	323A32	LBAFB			A	
38	THIRD STAGE TURBINE	323A33	LBAFC			A	

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39	TURBINE ROTOR	323A3400	LBAFD			A	
40	INNER AIR BAFFLE	323A3420	LBAFE			A	
41	INTERSTAGE SEAL	323A3440	LBAFF			5	
42	TURBINE SHAFT	323A3450	LBAFG			A	
43	TURBINE CASING	323A3500	LBAFH			A	
44	TURBINE ROTOR SHROUD	323A3510	LBAFJ			A	
45	IMPINGEMENT MANIFOLD	323A3520	LBAFK			A	
46	TURBINE FRAME	323A3600	LBAFL			A	
47	VANE	323A3620	LBAFM			A	
48	INNER/OUTER CONE	323A3630	LBAFN			A	
49	SUPPORT	323A3640	LBAFP			A	
50	COOLING BAFFLE	323A3650	LBAFQ			6	
51	FRAME CONE SUPPORT	323A3660	LBAFR			A	
52	ROTOR SPILL BAFFLE	323A3670	LBAFS			7	
53	BEARING NO 3	323A3680	LBAFT			A	
54	CARBON OIL SEAL	323A3690	LBAFU			5	
	MAIN ENGINE THRUST	3	LBAA	LBAB	LBA		AAAAAAAAA
	MAIN ENGINE THRUST		LBAA	LBAF			
56	INNER REAR CONE	323A41	LBAAA			A	
57	FORWARD EXHAUST DUCT	323A4300	LBAAB			A	
58	LINER	323A4310	LBAAC			A	
59	CONE	323A4341	LBAAD			A	
60	REAR EXHAUST DUCT	323A4400	LBAAE			A	
61	LINER	323A4310	LBAAF			A	
62	OUTER SHELL	323A4420	LBAAG			A	
	ACCESSORY DRIVE	3	LBAK	LBAL	LBABD		AAAAAAAAA
		3	LBAK	LBAS	LBCD		AAAAAAAAA
		3	LBAK		KCB		AAAAAAAAA
		3	LBAK		KEB		AAAAAAAAA
		3	LBAK		LKAU		AAAAAAAAA
		3	LBAK		LHAAA		AAAAAAAAA
		3	LBAK		LBADA		AAAAAAAAA
	ACCESSORY DRIVE		LBAK		LBAJB		AAAAAAAAA
			LBAK		LBADB		AAAAAAAAA
			LBAK		LBAQC		AAAAAAAAA
71	FRONT GEARBOX	323A51	LBAKA			A	
72	TRANSFER GEARBOX	323A5200	LBAKB			A	
73	RADIAL DRIVE SHAFT	323A5210	LBAKC			A	
74	DRIVE SHAFT HOUSING	323A5220	LBAKD			A	
75	REAR GEARBOX	323A53	LBAKE			A	
76	BEARING HOUSING	323A54	LBAKF			A	
	A/B COMBUSTION	3	LBAP	LBAQA	LBABC		AAAAAAAAA
		3	LBAP	LBARA	LBAN		AAAAAAAAA
	A/B COMBUSTION		LBAP	LBAC			
	REAR EXHAUST DUCT	323A4400	LBAAE			A	
	LINER	323A4310	LBAAF			A	
	OUTER SHELL	323A4420	LBAAG			A	
	AFTERBURNER THRUST	3	LBAN	LBAB	LBA		020000000
	A/B THRUST		LBAN	LBAP			
	INLET GUIDE VANE POSITION	3	LBAJ	LBAJA	LBADB		0A1111110
		3	LBAJ		LBAH		999999999
	INLET GUIDE VANE POSITION		LBAJ		LBAJB		AAAAAAAAA
	INLET GUIDE VANE ACTUATION	3	LBAJA	LBAJB	LBAJ		AAAAAAAAA
89	GUIDE VANE SUPPORT	323A1130	LBAJAA			A	
90	GUIDE VANE	323A1140	LBAJAB			A	
91	GUIDE VANE BEARING	323A1150	LBAJAC			A	
92	HALF RING ASSEMBLY LH	323A1160	LBAJAD			5	
93	LEVER ARM	323A1161	LBAJAE			A	
94	BELLCRCANK SUPPORT	323A1220	LBAJAF			A	
95	MAIN CRANK	323A1230	LBAJAG			A	
96	MASTER ROD	323A1240	LBAJAH			A	
97	LH ACTAUTOR	323A118*	LBAJAJ			5	
98	RH ACTUATOR	323A11**	LBAJAK			5	
99	HALF RING ASSEMBLY RH	323A1160	LBAJAL			5	
	VANE CONTROL	3	LBAJB	LBAJ	LBAJA		AAAAAAAAA
		3	LBAJB	LBAH	LBABC		AAAAAAAAA
		3	LBAJB	LBAK			
	VANE CONTROL		LBAJB	LBADB			
			LBAJB	LBADA			
A4	FEEDBACK SIGNAL SHAFT	323A11**	LBAJBA			A	
	ENGINE COOLING AIR		LBAL	LBEA	LBAC		AAAAAAAAA
			LBAL	LBFA	LBAK		FAAAAAAAAA
	AUX AIR DOOR POSITION	3	LBEA	LBEC	LBAH		521111125
		3	LBEA		LBEB		AAAAAAAAA
		3	LBEA		LBAL		AAAAAAAAA
A8	AUXILLIARY AIR DOOR	311331	LBEAA			A	
	AUX AIR DOOR ACTATION	3	LBEC	LBED	LBEA		AAAAAAAAA
		3	LBEC	KEA			

B0 AUX AIR DOOR ACTUATOR	311332	LBECA			A	
AUX AIR DOOR CONTROL	3	LBED	LBEF	LBEC		AAAAAAAAA
AUX AIR DOOR SELECTOR VALVE	311334	LBEDA			A	
PILOT MODE SELECT	3	LBEF	L	LBED		AAAAAAAAA
	3	LBEF	KBB			
B5 AUX AIR DOOR RELAY	31133*	LBEFA			A	
LANDING GEAR HANDLE SWITCH	313112	DADB		LBEF	A	
5 AMP CIRCUIT BREAKER	31133*	DADA		LBEF	A	
DOOR POSITION INDICATION	3	LBEB	LBEA	H		500000009
	3	LBEB	KAE			
WARNING LIGHT	311333	LBEBA			A	
AUX LANDING GEAR RELAY	31311*	DADC		LBEB	A	
AUX AIR DOOR POSITION SW	31133*	LBEBB			A	
BELLMOUTH POSITION	3	LBFA	LBFB	LBAL		0A1111100
	3	LBFA		LBAH		131111131
C5 BELLMOUTH RING	329A11	LBFAA			A	
BELLMOUTH ACTUATION	3	LBFB	LBFC	LBFA		AAAAAAAAA
C7 ACTUATOR	329A12	LBFBA			A	
C8 CABLE	329A13	LBFBB			A	
C9 PULLEY	329A14	LBFBC			A	
D3 SECTOR	329A15	LBFBD			A	
D1 IDLER-ROD, AND BELLCRANK	329A1F	LBFBE			A	
SENSING AND CONTROL	3	LBFC	CF	LBFB		AAAAAAAAA
	3	LBFC	KEA			
SENSING AND CONTROL		LBFC	LBAH			
D4 CONTROLLER	329A16	LBFCA			A	
D5 PITOT TUBE	329A1H	LBFCD			A	
D6 STATIC SENSOR	329A1*	LBFCE			A	
INLET AIR TEMP HIGH WARNING	3	LBEE	KAE	H		AAAAAAAAA
	3	LBEE	LBAH			
TEMP SENSOR	31131*	LBEEA			A	
5 AMP FUSE	31131*	LBEEB			A	
WARNING LIGHT	31131*	LBEEC			A	
MAIN FUEL DELIVERY	3	LBADD	LBADC	LBAC		0A5555430
	3	LBADD		LBARA		AAAAAAAAA
MAIN FUEL DELIVERY		LBADD		LBCB		FAAAAAAAAA
		LBADD		LBAQA		F555555555
G3 PRIMARY FUEL NOZZLE	323A68	LBADDA			A	
G4 SECONDARY FUEL NOZZLE	323A68	LBADDB			A	
G5 FUEL TUBING	323A67	LBADDC			A	
PRESSUREIZE AND DRAIN	3	LBADC	LBADB	LBADD		AAAAAAAAA
G7 PRESSURIZE AND DUMP VALVE	323A65	LBADCA			A	
FUEL REGULATION AND CONTROL	3	LBADB	LBAJ	LBAJB		FAAAAAAAAA
	3	LBADB	LBADA	LBARB		FAAAAAAAAA
REGULATION AND CONTROL		LBADB	LBAG	LBADE		AAAAAAAAA
		LBADB	LBAH	LBADC		AAAAAAAAA
		LBADB	LBAK	LBAQB		FAAAAAAAAA
		LBADB	LBAB			
		LBADB	BGAB			
		LBADB	KBA			
		LBADB	L			
H1 MAIN FUEL CONTROL	323A6200	LBADBA			A	
H2 TORQUE BOOSTER CONTROL	323A63	LBADBB			A	
H3 FUEL OIL COOLER	323A64	LBCBB			A	
5 AMP FUSE	323A62**	LBADBC			A	
INLET TEMPERATURE SENSOR	323A6210	LBADBD			A	
H6 THROTTLE LEVER	329311	LBGAAA			A	
H6 FUEL FLOW TRANSMITTER	351442	LBADEA			A	
FUEL FLOW INDICATION	3	LBADE	LBADB	H		AAAAAAAAA
	3	LBADE	KAD			
FUEL FLOW TRANSMITTER	351442	LBADEA			A	
FUEL FLOW INDICATOR	351441	LBADEB			A	
5 AMP FUSE	35144*	LBADEC			A	
FUEL SUPPLY PRESSURIZE	3	LBADA	LBAK	LBADB		AAAAAAAAA
	3	LBADA	LBBA	LBAJB		
J4 MAIN FUEL PUMP	323A6100	LBADAA			A	
J5 BYPASS INDICATOR SWITCH	323A6110	LBADAB			1	
FUEL FILTER	323A610*	LBADAC			A	
TEMPERATURE AMPLIFIER	323A93	LBABCB			A	
A/B FUEL DELIVERY	3	LBAQA	LBAQB	LBAP		AAAAAAAAA
A/B FUEL DISTRIBUTION		LBAQA	LBADD	LBCB		F555555555
		LBAQA		LBARA		AAAAAAAAA
A/B FUEL SPRAYBAR	323A74	LBAQAA			A	
A/B FUEL MANIFOLD	323A75	LBAQAB			A	
FUEL OIL COOLER	323A72	LBCBC			A	
TUBING	323A77	LBAQAC			A	
PRESSURIZING VALVE	323A73	LBAQAD			A	
A/B FUEL REGULATION	3	LBAQB	LBADB	LBAQA		AAAAAAAAA
	3	LBAQB	LBAQC			

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		3	LBAGB	LBAG			
		3	LBAGB	L			
	A/B FUEL CONTROL	323A78	LBAGBA			A	
	THROTTLE LEVER	329311	LBGAAA			A	
	A/B FUEL PRESSURIZE	3	LBAGC	LBAK	LBAGB		AAAAAAAAA
		3	LBAGC	LBBA			
	A/B FUEL PUMP	323A7100	LBAGCA			A	
	CHECK VALVE	323A7110	LBAGCB			A	
	FILTER	323A710*	LBAGCC			A	
	PUMP VENT VALVE	323A7120	LBAGCD			A	
	FUEL INLET VALVE	323A7130	LBAGCE			A	
	ON/OFF VALVE	323A7140	LBAGCF			A	
	ENGINE IGNITION	3	LBAEA	LBADD	LBAC		00AAAAA00
		3	LBAEA	LBAEB			
L8	IGNITER PLUG	323AA*	LBAEAA			A	
L9	HIGH TENSION LEAD	323AA5	LBAEAB			A	
	IGNITION GENERATION	3	LBAEB	LBAEC	LBAEA		AAAAAAAAA
		3	LBAEB	LBARB	LBARA		FAAAAAAAAA
		3	LBAEB		LBAB		AAAAAAAAA
M2	IGNITION EXCITER UNIT	323AA1	LBAEBA			A	
	MODE SELECT	3	LBAEC	L	LBAEB		AAAAAAAAA
		3	LBAEC	KAC			
M5	THROTTLE SWITCH	323AA*	LBAECA			A	
M6	5 AMP FUSE	323AA*	LBAECB			A	
	AFTERBURNER IGNITION	3	LBARA	LBAEB	LBAP		AAAAAAAAA
		3	LBARA	LBAGA			
		3	LBARA	LBAG			
	A/B IGNITION		LBARA	LBADD			
N0	TORCH IGNITER	323A4340	LBARAA			A	
N1	IGNITER PLUG	323A434*	LBARAB			A	
	AFTERBURNER IGNITION CONT	3	LBARB	LBARC	LBAEB		AAAAAAAAA
		3	LBARB	LBADB	LBABC		AAAAAAAAA
N7	AFTERBURNER IGNITION SWITCH	323AA4	LBARBA			A	
N8	HYD XFER PUMP CONTROL RELAY	323AA*	LBARBB			A	
	AFTERBURNER MODE SELECT	3	LBARC	L	LBARB		AAAAAAAAA
		3	LBARC	KAH			
P1	THROTTLE LEVER	329311	LBGAAA			A	
P2	5 AMP FUSE	323AA*	LBARCA			A	
	EXAUST NOZZLE POSITION	3	LBAB	LBABB	LBABA		AAAAAAAAA
		3	LBAB	LBAEB	LBAN		F999999999
		3	LBAB		LBAA		F888888888
	NOZZLE POSITION		LBAB		LBADB		AAAAAAAAA
			LBAB		LBA		SAAAAAAAAA
	NOZZLE POSITION INDICATION	3	LBABA	KRA	H		011111110
		3	LBABA	LBAB			
	5 AMP FUSE	35163*	LBABAA			A	
	NOZZLE POSITION INDICATOR	351637	LBABAB			A	
	NOZZLE ACTUATION	3	LBABB	LBABC	LBAB		AAAAAAAAA
		3	LBABB	LBABD	LBCE		AAAAAAAAA
Q0	OUTER SHROUD	323A4460	LBABBA			B	
Q1	SUPPORT RING	323A4470	LBABBB			A	
Q2	SHROUD FLAP	323A4471	LBABBC			A	
Q3	SHROUD FLAP SEAL	323A4472	LBABBD			2	
Q4	NOZZLE FLAP	323A4480	LBABBE			A	
Q5	NOZZLE FLAP SEAL	323A4481	LBABBF			5	
Q6	NOZZLE FLAP HINGE	323A4482	LBABBG			A	
	CAM LINK ACTUATOR	323A4490	LBABBH			A	
Q8	ACTUATOR	323A4440	LBABBJ			4	
Q9	ACTUATOR	323A4440	LBABBK			4	
R0	ACTUATOR	323A4440	LBABBL			4	
R1	ACTUATOR	323A4440	LBABBM			4	
R2	ROD	323A4450	LBABBN			4	
R3	ROD	323A4450	LBABBP			4	
R4	ROD	323A4450	LBABBQ			4	
R5	ROD	323A4450	LBABBR			4	
R6	NOZZLE AREA CONTROL VALVE	323A6A	LBABBS			A	
R7	FEEDBACK CABLE	323A4***	LBABBT			A	
	PRESSURE GENERATION	3	LBABD	LBCD	LBABB		AAAAAAAAA
		3	LBABD	LBAK			
		3	LBABD	LBCF			
S0	NOZZLE PUMP	323A88	LBABDA			A	
	SIGNAL SENSING	3	LBABC	LHABB	LBABB		AAAAAAAAA
		3	LBABC	LBAJB			
		3	LBABC	LBARB			
		3	LBABC	LBAG			
		3	LBABC	LBAP			
		3	LBABC	CF			
S3	CONTROL ALTERNATOR	323A92	LBABCA			A	
S4	TEMPERATURE AMPLIFIER	323A93	LBABCB			A	
	EXHAUST GAS THERMOCOUPLE	351424	LBABCC			A	
S6	BRANCHED CABLE	323A91	LBABCD			A	

01	*FUEL DELIVERY TO LH ENGINE	4	LBBA	KBA	LBADA		0A5555530
		4	LBBA	BBB			
	FUEL DELIVERY TO ENGINES		LBBA		LBA0C		AAAAAAAAA
	STRAINER/DRAIN VALVE	429C1*	LBBAA			A	
	MAINFOLD SHUTOFF VALVE	446136	LBBAB			A	
	ENGINE FEED MANIFOLD	446137	LBBAC			A	
16	LH PUMP CHECK VALVE	446133	LBBBC			1	
	L DROP TANK PILOT VALVE	446222	LBBHJ			A	
	L DROP TANK FUEL CONTROL V	446224	LBBHK			A	
	L DROP TANK FUEL DISCONNECT	44623*	LBBHL			A	
	L DROP TANK FUEL SHUTOFF V	446226	LBBHM			A	
	L DROP TANK	446232	LBBHP			A	
	L DROP TANK AIR DISCONNECT	44621B	LBBJF			A	
	L DROP TANK PRESS/VENT V	44621D	LBBJG			A	
	L DROP TANK PRESS REGULATOR	446215	LBBJH			A	
	LH HOT AIR CHECK VALVE	446216	LBBJJ			A	
	L PRESSURE CHECK FITTING	44621C	LBBJK			A	
	L FUEL FLOW SWITCH	44622A	LBBKB			A	
	L WING I/B LEVEL SHUTOFF V	44617B	LBBLA			A	
	L WING O/B LEVEL SHUTOFF V	44617B	LBBLB			A	
	L WING TANK	446171	LBBLC			A	
	L WING TANK PRESS REGULATOR	446112	LBBMA			A	
	L HOT AIR CHECK VALVE	446116	LBBMB			A	
	L WING PRESS CHECK FITTING	446117	LBBMC			A	
	L WING PRESS/VENT VALVE	446118	LBBMD			A	
	L WING TANK DRAIN VALVE	44611A	LBBMF			A	
E5	L ENGINE MASTER SWITCH	423A9*	LBBNG			A	
	L PRESSURE TRANSMITTER	451845	LBBEA			A	
	L PRESSURE INDICATOR	451846	LBBEB			A	
	L WING TANK LEVEL CONTROL V	446153	LBBPA			A	
	L DROP TANK FEUL SHUTOFF V	446226	LBBHM			A	
	L DROP TANK CONTROL VALVE	446224	LBBHK			A	
	ENGINE OIL DISTRIBUTION	-	LBCA	LBCB	LBCF		0A5555520
	DISTRIBUTION		LBCA		LBAS		FAAAAAAAAA
			LBCA		LBAF		FAAAAAAAA
			LBCA		LBA		SAAAAAAAAA
02	OIL NOZZLES	-23A8710	LBCAA			A	
03	OIL TUBING	-23A8700	LBCAB			A	
	OIL SCAVENGE	-	LBCF	LBCA	LBCE		AAAAAAAAA
	SCAVANGE		LBCF		LBABD		333333333
06	NO 1 SCAVENGE PUMP	-23A82	LBCFA			A	
07	NO 2 SCAVENGE PUMP	-23A83	LBCFB			A	
08	NO 3 SCAVENGE PUMP	-23A84	LBCFC			A	
09	CSD FILTER	-42227	LBCFD			A	
10	VARIABLE NOZZLE FILTER	-23A**	LBCFE			2	
11	VARIABLE NOZZLE FILTER	-23A**	LBCFF			2	
12	CHECK VALVE	-23A**	LBCFG			A	
13	SCAVENGE OIL FILTER	-23A**	LBCFH			2	
	OIL SUPPLY	-	LBCE	LBABB	LBCH		AAAAAAAAA
		-	LBCE	LBCF	LBCD		AAAAAAAAA
		-	LBCE		LKAU		AAAAAAAAA
17	OIL TANK	-23A8500	LBCEA			A	
18	PRESSURIZE/VACUUM VALVE	-23A8510	LBCEB			A	
19	CHECK VALVE	-23A85**	LBCEC			A	
	LOW LEVEL WARNING	-	LBCH	LBCE	H		022222220
		-	LBCH	KAE			
	OIL LEVEL AMPLIFIER	-23A9*	LBCHA			A	
	LOW LEVEL WARNING LIGHT	-23A9*	LBCHB			A	
	OIL LEVEL SENSOR	-23A9*	LBCHC			A	
	5 AMP FUSE	-23A9*	LBCHD			A	
	PRESSURE GENERATION	-	LBCD	LBCE	LBCG		AAAAAAAAA
		-	LBCD	LBAK	LBABD		084444430
		-	LBCD		LBCC		AAAAAAAAA
29	MAIN OIL PUMP	-23A81	LBCDA			A	
	OIL PRESSURE INDICATION	-	LBCG	LBCD	H		999999999
		-	LBCG	KAD			
	5 AMP FUSE	-23A9*	LBCGA			A	
	PRESSURE TRANSMITTER	-51434	LBCGB			A	
	PRESSURE INDICATOR	-51433	LBCGC			A	
	PRESSURE REGULATION	-	LBCC	LBCD	LBCB		AAAAAAAAA
36	RELIEF VALVE	-23A8*	LBCCA			A	
	TEMPERATURE CONTROL	-	LBCB	BAZ	LBCA		AAAAAAAAA
		-	LBCB	LBADD	LBCJ		033333330
		-	LBCB	LBCC			
39	AIR OIL COOLER	-23A8*	LBCBA			3	
40	MAIN FUEL OIL COOLER	-23A64	LBCBB			A	
41	AOD FUEL OIL COOLER	-23A72	LBCBC			1	
42	TEMPERATURE REGULATOR	-23A86	LBCBD			A	
	OIL TEMPERATURE INDICATION	-	LBCJ	LBCB	H		033333330
	THERMOCOUPLE SENSOR	-51424	LBCJA			A	
	TEMPERATURE INDICATOR	-51425	LBCJB			A	

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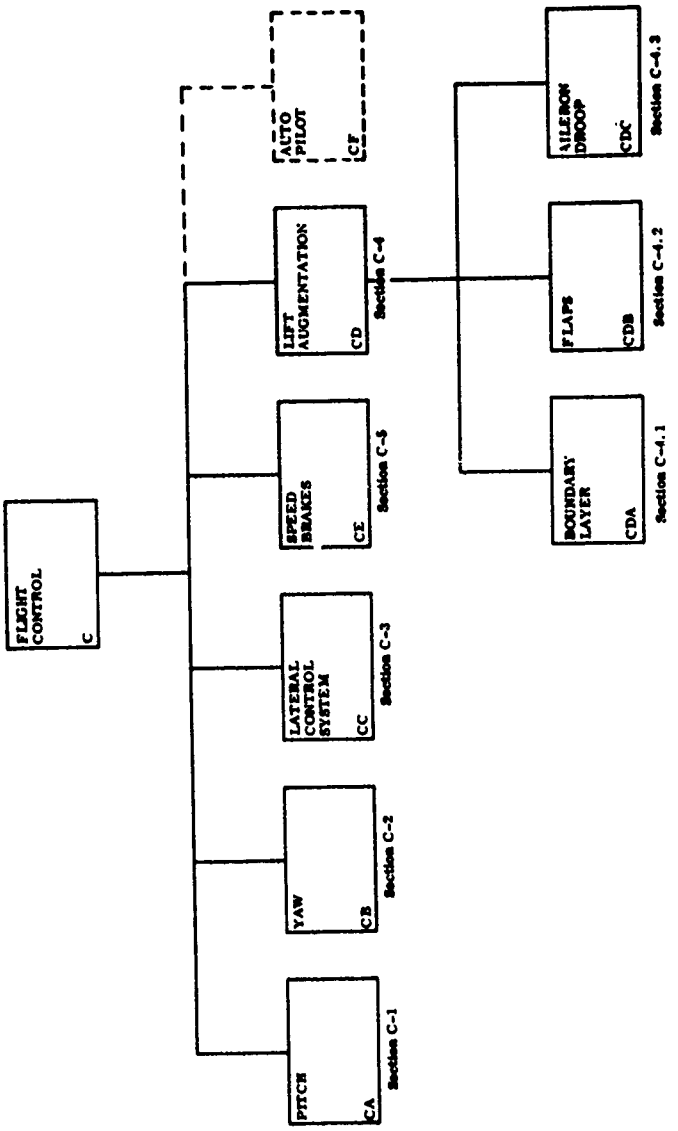
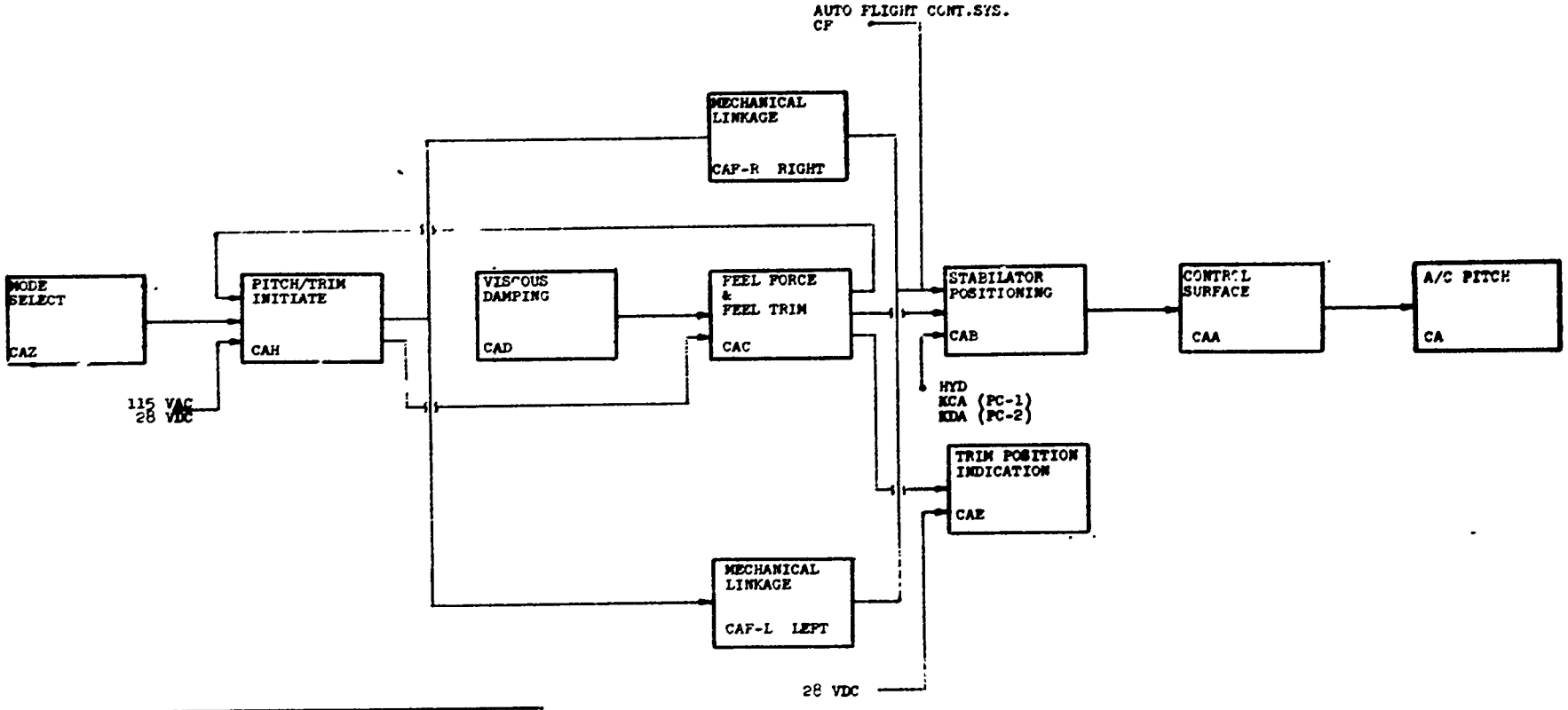
C. FLIGHT CONTROL SECTION



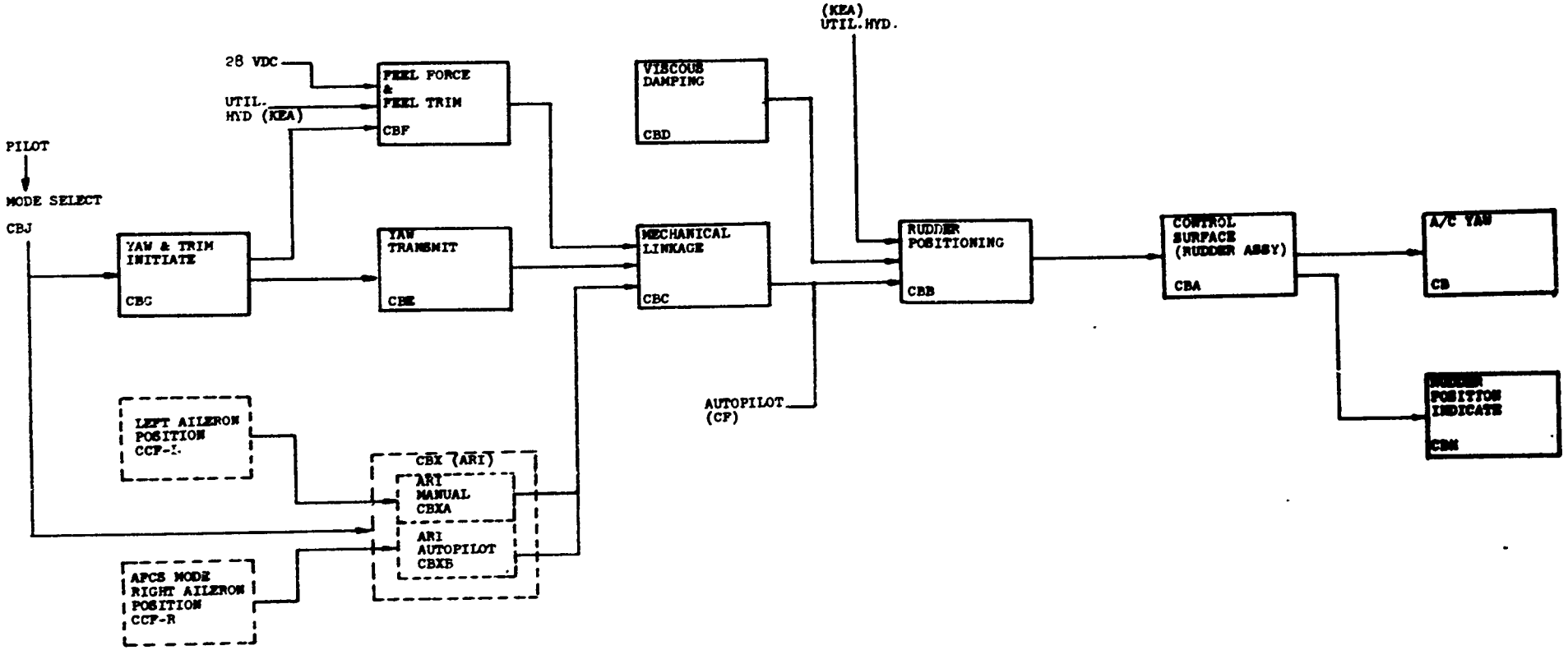
Aircraft: F-4J	
Title: Functional Diagram FLIGHT CONTROL SECTION	
Document: NA	rev. date NA
Date: 23 Apr 1968	

Section C

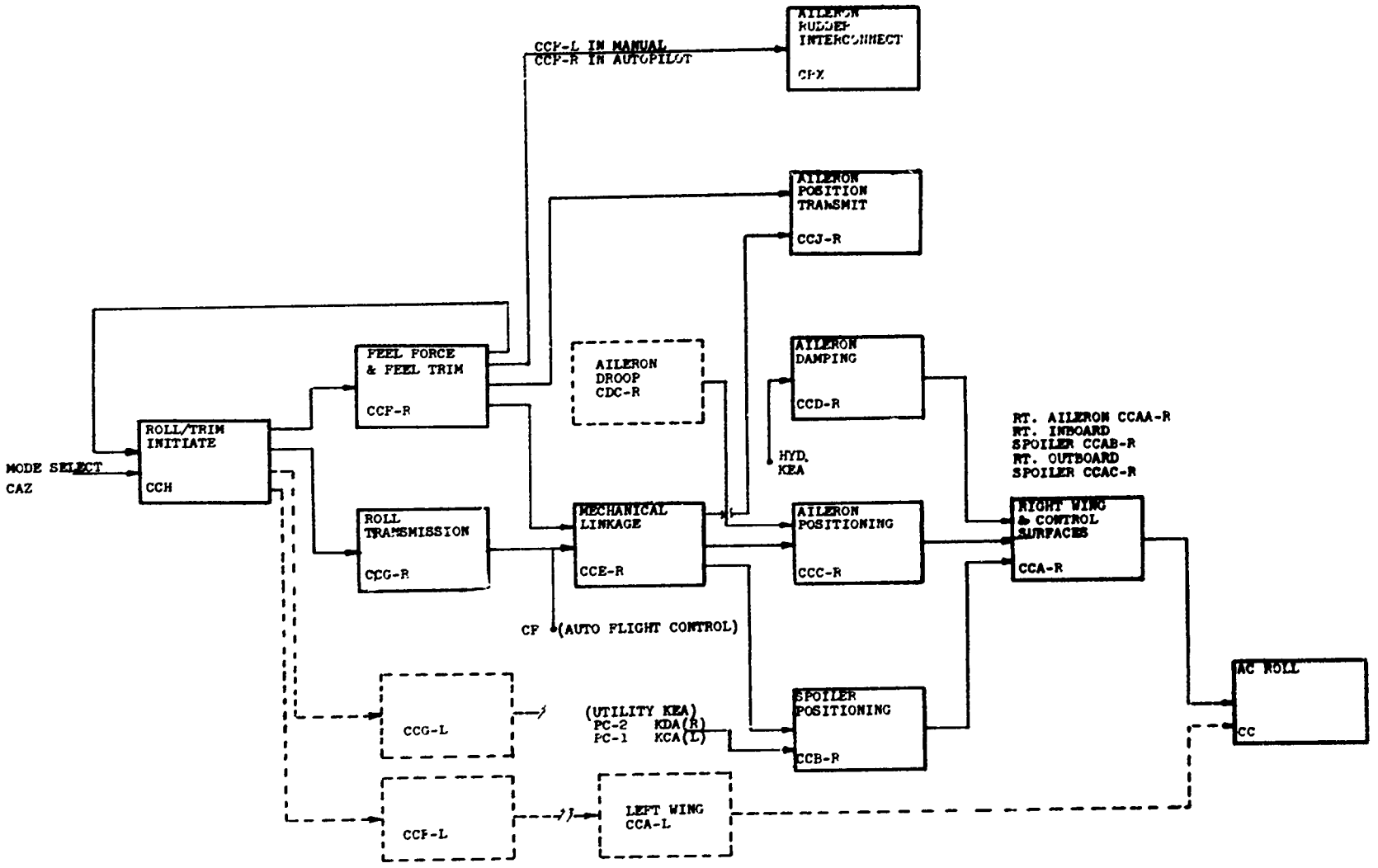


Aircraft: F-4J	
Title: Functional Diagram STABILATOR CONTROL SYSTEM (PITCH)	
Document: NAVAIR 01-245FDB-2-2.2	**rev. date** 15 Apr 1968
Date: 23 Apr 1969	

Section C-1



Aircraft: F-4J	
Title: Functional Diagram A/C YAW (RUDDER CONTROL SYSTEM)	
Document: NAVAIR 01-245FDB-2-2.2	**rev. date** 15 Apr 1968
Date: 23 Apr 1969	



Aircraft: F-4J	
Title: Functional Diagram LATERAL CONTROL SYSTEM	
Document: NAVAIR 01-245FDB-2-2.2	**rev. date** 15 Apr 1968
Date: 23 Apr 1969	

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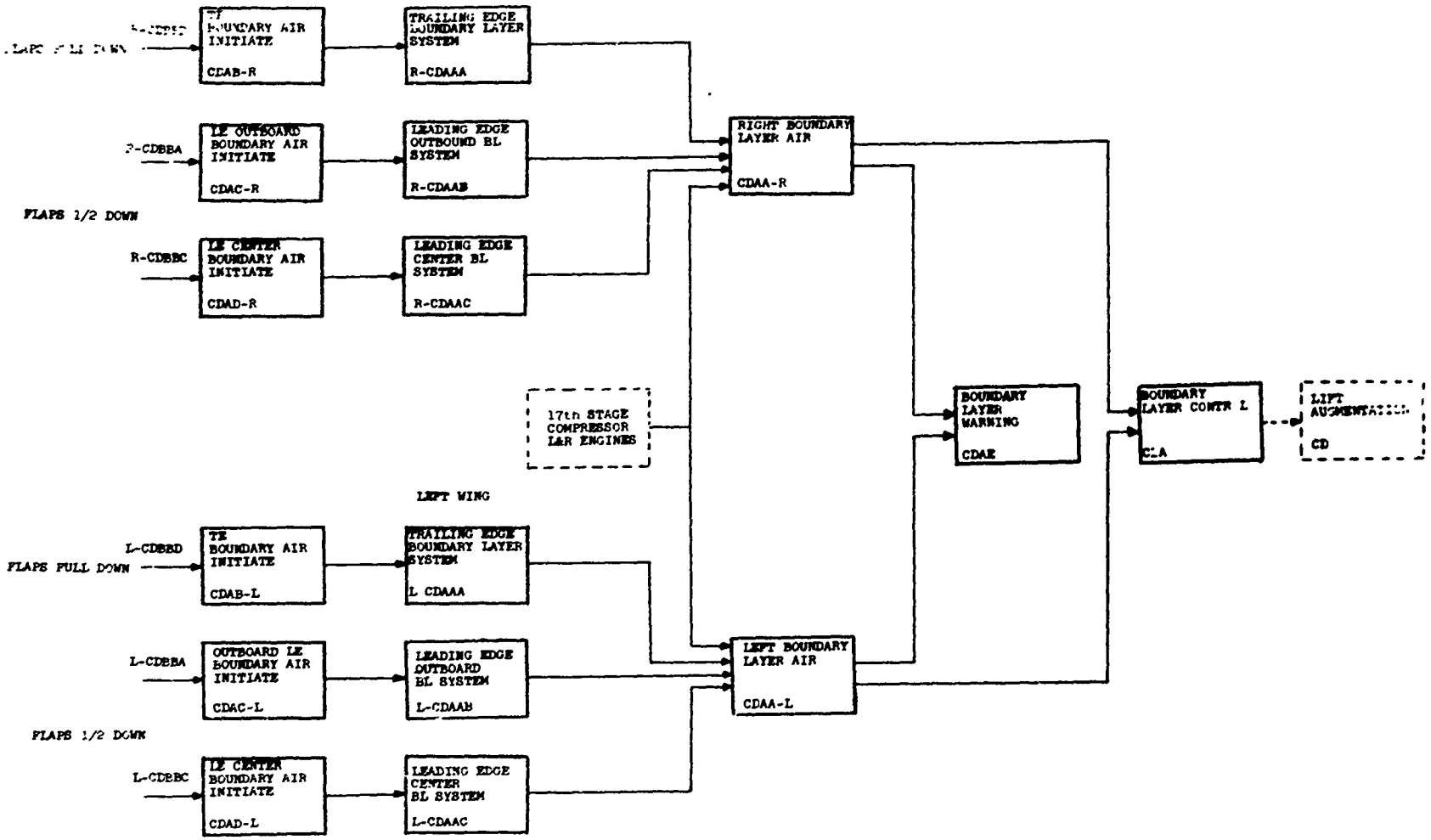

A-41

Section C-4.1

Aircraft: F-4J	
Title: Functional Diagram BOUNDARY · LAYER · CONTROL	
Document: NAVAIR 01-245FDB-2-2.2	**rev. date** 15 Apr 1968
Date: 23 Apr 1969	

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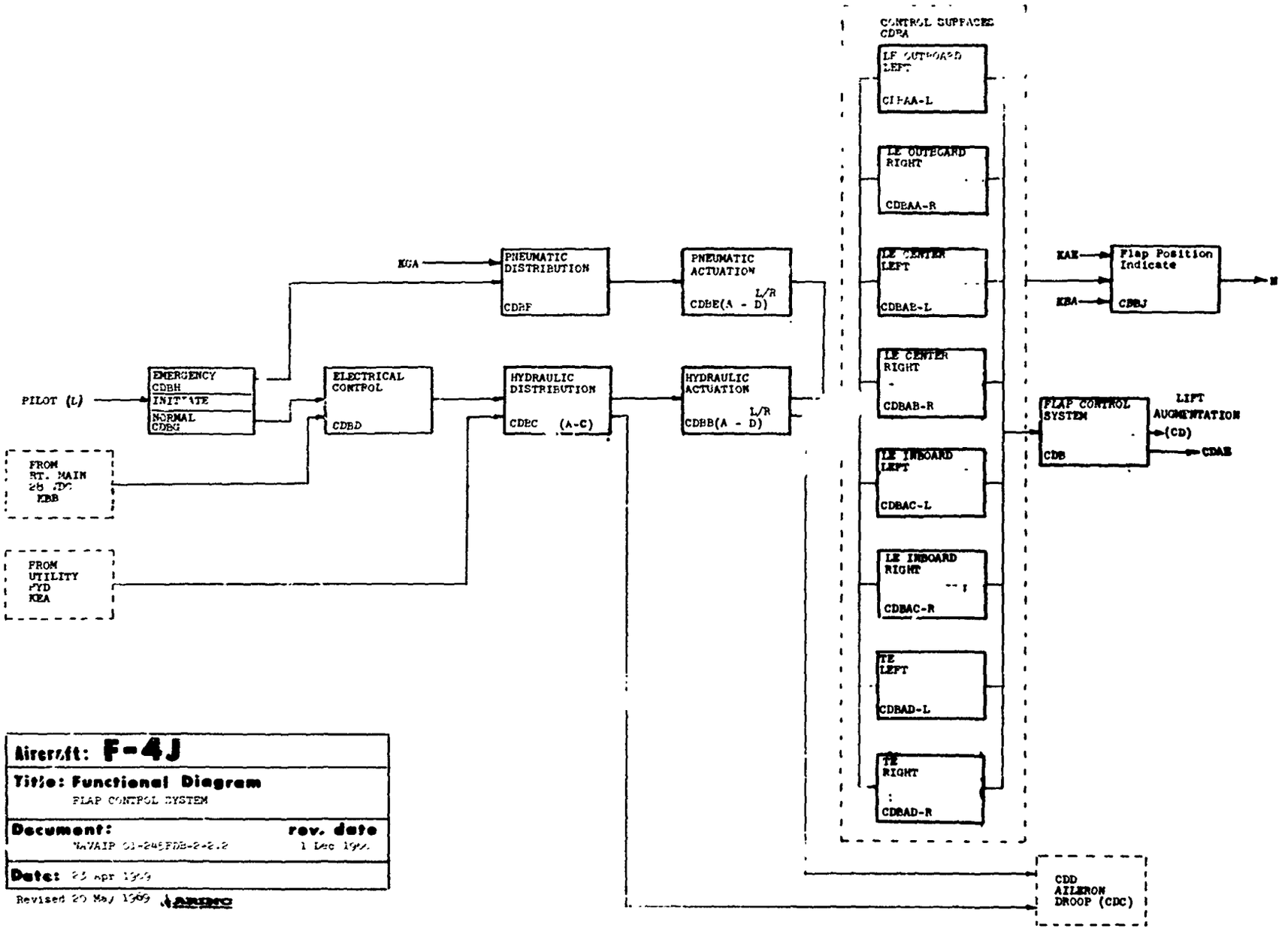

Aircraft: F-4J

Title: Functional Diagram
FLAP CONTROL SYSTEM

Document: NAVAIR 01-245FDB-2-2.2 **rev. date** 1 Dec 19??

Date: 23 Apr 1969

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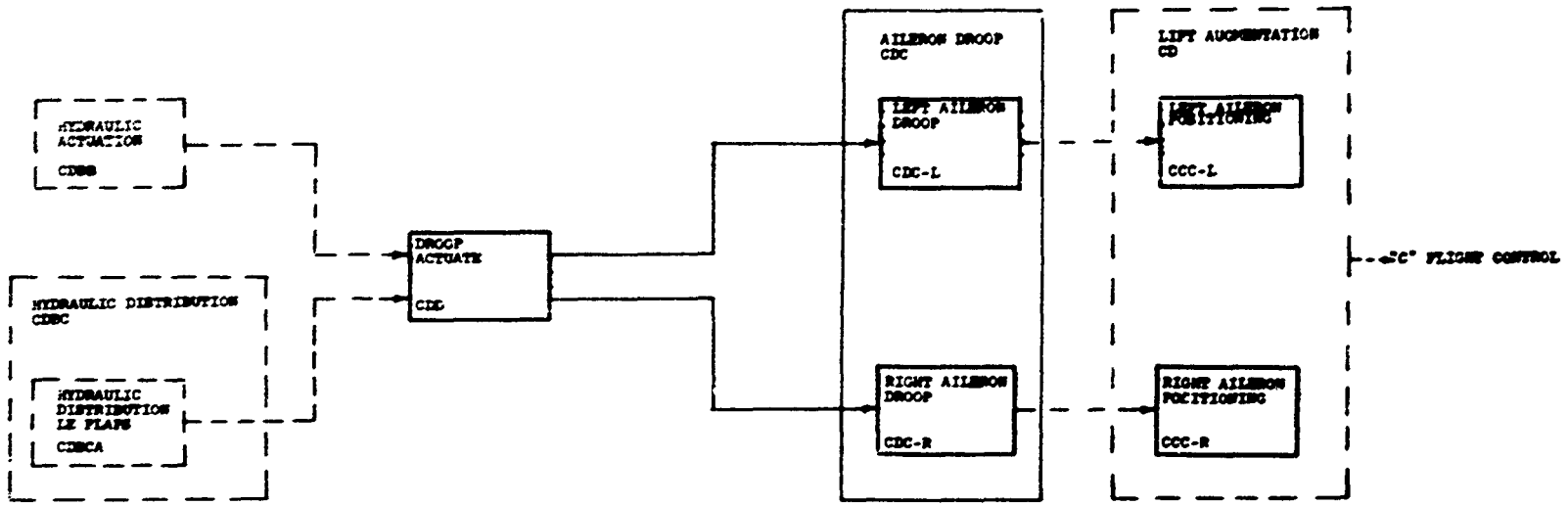
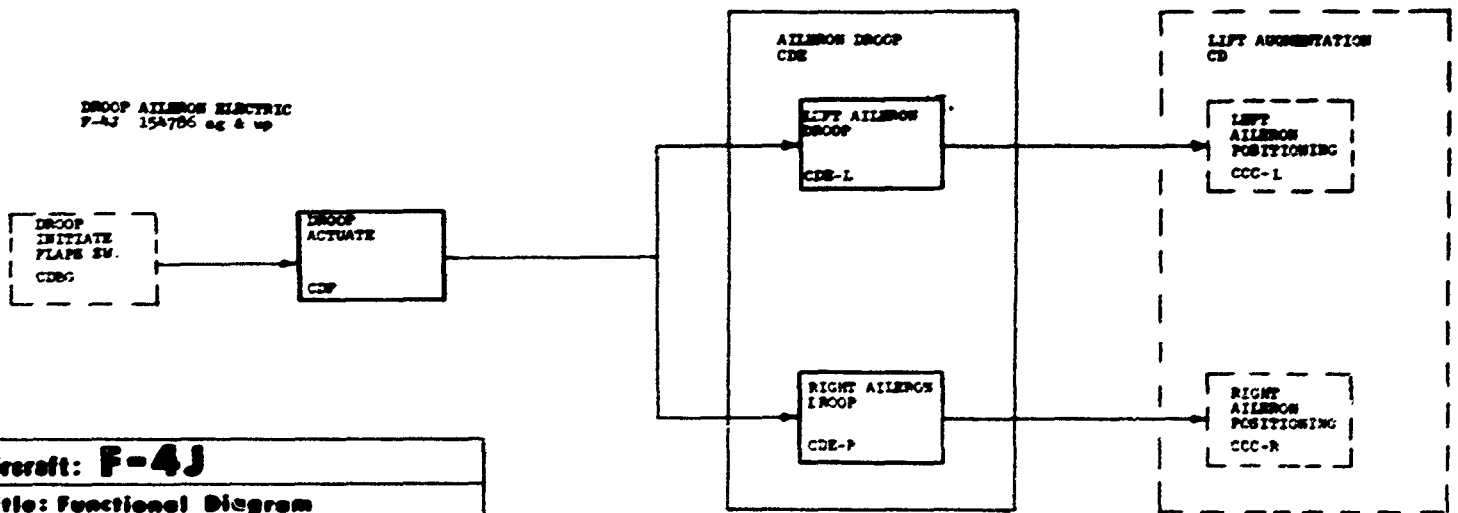
DROOP AILERON HYDRAULIC
F-4J 153071Z thru 154765 ef

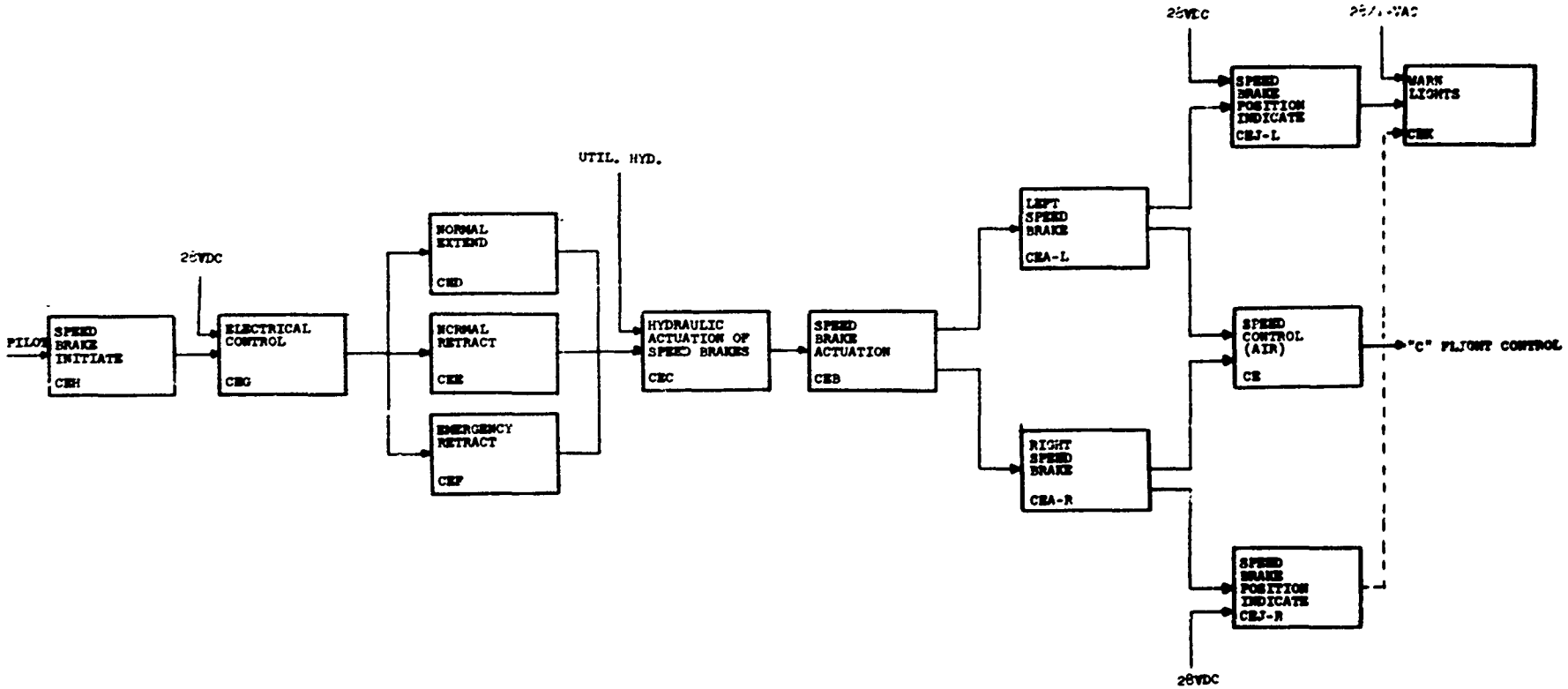


DROOP AILERON ELECTRIC
F-4J 154766 eg & up



Aircraft: F-4J	
Title: Functional Diagram	
AILERON DROOP	
Document:	**rev. date**
NAVAIR 01-245FAA-2-2.2	15 Apr 1973
Date: 15 Apr 1973	

Section C-4.1



Aircraft: F-4J	
Title: Functional Diagram SPEED BRAKES	
Document: NAVAIR 01-245FDB-2-2.2	**rev. date** 15 Apr 1968
Date: 23 Apr 1969	

TITLE	WUC	ALPHA	INPUT	DEP FUNC	CD FC	AL FN	W	SENSITIVITY 123456789
*FLIGHT CONTRGLS		C	CA					0AAAAAAA0
		C	CB					
		C	CC					
		C	CD					
		C	CE					
		C	CF					
*AIRCRAFT PITCH		CA	CAA	C				0AAAAAAA0
CONTROL SURFACE		CAA	CAB	CA				AAAAAAAAA
STABILATOR ASSEMBLY	14310	CAAA					A	
COVER ASSEMBLY	14311	CAAB					2	
STEEL TE HONEYCOMB	14312	CAAC					2	
ALUM TE HONEYCOMB	14313	CAAD					2	
SLOTTED LEADING EDGE	14314	CAAE					5	
HINGE FITTING	14315	CAAF					A	
STABILATOR TIP	14316	CAAG					2	
STABILATOR SKIN	14317	CAAH					2	
ACTUATOR FITTING	14318	CAAJ					A	
*STABILATOR POSITIONING		CAB	CF	CAA				AAAAAAAAA
		CAB	KCA					
		CAB	KDA					
		CAB	CAC					
		CAB	RCAF					
		CAB	LCAF					
		CAB	KEA					
STABILATOR POWER CNT CYL	14326	CABA					A	
TORQUE TUBE ASSEMBLY	1433A	CABB					A	
FORCE LINK SWITCH	14338	CABC					0	
FORCE LINK SPRING CARTRIDGE	14335	CABD					A	
POWER CONTROL VALVE	14327	CABE					A	
CONTROL ROD	14328	CABF					A	
FORCE LINK BELLCRANK	1432A	CABG					A	
STAB CONTROL HORN	1432*	CABH					A	
OVERRIDE SPRING CARTRIDGE	14336	CABJ					A	
*MECHANICAL LINKAGE RIGHT		RCAF	CAG	CAB				555555555
CONTROL CABLE	1432C	RCAFA					A	
BELLCRANK	1432*	RCAFB					A	
TURNBUCKLES	1432*	RCAFC					A	
PULLEY	1432*	RCAFD					A	
*MECHANICAL LINKAGE LEFT		LCAF	CAG	CAB				555555555
CONTROL CABLE	1432C	LCAFA					A	
BELLCRANK	1432*	LCAFB					A	
TURNBUCKLES	1432*	LCAFC					A	
PULLEY	1432*	LCAFD					A	
*PITCH AND TRIM INITIATE		CAG	CAC	RCAF				FAAAAAAAAA
		CAG	CAZ	LCAF				FAAAAAAAAA
		CAG	KAA	CAB				SAAAAAAAAA
		CAG	KBA					
TORQUE TURE BELLCRANK	1433*	CAGA					A	
PUSH ROD	1433*	CAGB					A	
TORQUE TURE	1411B	CCHA					A	
CONTROL STICK ASSY	14110	CCHB					A	
TRIM SWITCH	14115	CCHC					A	
*FEEL FORCE AND FEEL TRIM		CAC	CAD	CAG				AAAAAAAAA
		CAC	CAG	CAB				072222270
		CAC		CAE				AAAAAAAAA
FEEL TRIM ACTUATOR	14331	CACA					A	
BELLOWS ASSY	14332	CACB					A	
LINK ASSY	1432E	CACC					A	
FEEL TRIM PICKUP PROBE HTR	14337	CACD					A	
TRIM VENTURI HEATER	14338	CACE					A	
TRIM RELAY PANEL	1433C	CACF					A	
IDLER ASSY	14330	CACG					A	
LIMIT SWITCH	1433E	CACH					A	
FEEL SYSTEM PISTON	14325	CACJ					A	
FEEL SYSTEM BALANCE ASSY	14323	CACK					A	
LONG BELLOWS BELL	14324	CACL					A	
FEEL SYSTEM BALANCE	14321	CACM					A	
*VISCOUS DAMPING		CAD		CAC				022222220
STAB VISCOUS DAMPER	14334	CADA					A	
*TRIM POSITION INDICATE		CAE	KBE	H				001000020
		CAE	CAC					
POSITION TRANSMITTER	51625	CAEA					A	
STAB POSITION INDICATOR	5162A	CAEB					A	
MODE SELECT		CAZ	L	CAG				0AAAAAAA0
*AIRCRAFT YAW		CB	CBA	C				082222280
*CONTROL SURFACE		CBA	CBB	CBH				AAAAAAAAA
		CBA		CB				AAAAAAAAA
RUDDER ASSEMBLY	14410	CBAA					A	
HORN ASSY	14411	CBAB					A	
TE HONEYCOMB	14412	CBAC					2	
TE ASSY	14413	CBAD					3	

RUDDER STRUCTURE	14414	CBAE			A
HINGE FITTING	1441A	CBAF			A
COUNTER BALANCE WEIGHT	1441*	CBAG			B
RUDDER ROTARY DAMPER	14425	CBAH			B
*RUDDER POSITIONING		CBB	CBD	CBA	AAAAAAAAA
		CBB	CBC		
		CBB	CF		
		CBB	KEA		
RUDDER POWER CONTROL CYL	14423	CBBA			A
*MECHANICAL LINKAGE		CBC	CBE	CBA	AAAAAAAAA
		CBC	CBF		
		CBC	CBX		
WALKING BEAM BELLCRANK	1442*	CBCA			A
*VISCOUS DAMPING		CBD		CBB	055555550
RUDDER VISCOUS DAMPER	14424	CBDA			A
RELIEF VALVE	1442*	CBDB			A
CHECK VALVE	1442*	CBDC			A
*FEEL FORCE AND FEEL TRIM		CBF	CBG	CBC	072222270
		CBF	KEA		
		CBF	KBB		
RUDDER FEEL SELECTOR VALVE	14433	CBFA			A
RUDDER FEEL CYLINDER	14432	CBFB			A
ACTUATOR ASSY	14331	CBFC			A
IDLER ASSY	14436	CBFD			A
RUDDER AIR SPEED SWITCH	1442E	CBFE			A
*YAW TRANSMIT		CBE	CBG	CBC	AAAAAAAAA
RUDDER CONTROL CABLES	1442*	CBEA			A
CABLE PULLEY	1442*	CBEB			5
BELLCRANK	1442*	CBEC			A
CONTROL RODS	1442*	CBED			A
*YAW AND TRIM INITIATE		CBG	CAZ	CBF	FAAAAAAAAA
		CBG		CBE	FAAAAAAAAA
		CBG		CBC	SAAAAAAAAA
RUDDER PEDALS	14428	CBGA			A
TRIM SWITCH	14435	CBGB			A
RUDDER TRIM TRANSMITTER	51624	CBGC			A
*RUDDER POSITION INDICATE		CBH	KAD	H	031000010
RUDDER POSITION TRANSMITTER	51624	CBHA			A
RUDDER POSITION INDICATOR	51623	CBHB			A
*MODL SELECTION		CAZ	L	CBG	AAAAAAAAA
*AILERON RUDDER INTERCONNECT		CBX	CBXA	CBC	011111110
		CBX	CBXB		
		CBX	CAZ		
		CBX	KAB		
		CBX	KAA		
ARI MANUAL		CBXA	LCCF	CBC	011111110
ARI SERVO ACTUATOR	14422	CBXAA			A
ARI SERVO	14421	CBXAB			A
ARI AUTO		CBXB	RCCF	CBC	011111110
ARI SERVO ACTUATOR	14422	CBXAA			A
ARI SERVO	14421	CBXAB			A
*AIRCRAFT ROLL		CC	RCCA	C	0AAAAAAA0
		CC	LCCA		
*RT WING CONTROL SURFACES		RCCA	RCCB	CC	096666690
		RCCA	RCCC		
		RCCA	RCCD		
RIGHT AILERON ASSY	14210	RCCAA			A
RIGHT INBOARD SPOILER ASSY	14240	RCCAB			2
RIGHT OUTBOARD SPOILER ASSY	14240	RCCAC			2
*AILERON DAMPING		RCCD	KEA	RCCA	062222260
DAMPER CYLINDER ASSY	14221	RCCDA			A
RELIEF VALVE	14229	RCCDB			A
*SPOILER POSITIONING		RCCB	RCCE	RCCA	021111130
		RCCB	KDA		
		RCCB	KEA		
INBOARD SPOILER PWR CYL	14252	RCCBA			A
OUTBOARD SPOILER PWR CYL	14252	RCCBB			A
SPOILER FOLLOW UP ROD ASSY	1425*	RCCBBA			A
FOLLOW UP TORQUE TUBE ASSY	1425*	RCCBBB			A
LATERAL CONTROL ROD ASSY	1425*	RCCBBC			A
DUAL SERVO VALVE	14253	RCCBBD			A
*AILERON POSITIONING		RCCC	RCCE	RCCA	096666690
		RCCC	KEA		
		RCCC	KDA		
		RCCC	RCDC		
AILERON POWER CONTROL CYL	14222	RCCCA			A
LAT CTRL BELLCRANK ASSY	14225	RCCCB			A
LAT CTRL ROD ASSY	1421B	RCCCC			A
*MECHANICAL LINKAGE		RCCE	RCCF	RCCC	FAAAAAAAAA
		RCCE	CF	RCCB	FAAAAAAAAA

		RCCE		RCCA	SAAAAAAAAA
		RCCE	RCC6	RCCJ	AAAAAAAAA
WALKING BEAM BELLCRANK	14271	RCCEA			A
IDLER ASSEMBLY	14272	RCCEC			A
LATERAL CONTROL LINKAGE	14270	RCCED			A
*FEEL FORCE AND FEEL TRIM		RCCF	CCH	CCH	072222270
		RCCF	KAA	CCE	AAAAAAAAA
		RCCF		CBX	AAAAAAAAA
CARTRIDGE JACK ACTUATOR	14262	RCCFA			A
TRIM ROTARY ACTUATOR	14261	RCCFB			A
FLEX DRIVE CABLE	14266	RCCFC			A
ELECTRICAL CONTROL	1426*	RCCFD			A
ARI POSITION TRANSDUCER	5162R	CCFE			A
*ROLL TRANSMISSION		RCC6	CCH	RCCE	096666690
OVERRIDE SPRING CARTRIDGE	14223	RCC6A			A
LINKAGE	1422*	RCC6B			A
*AILERON POSITION TRANSMIT		RCCJ	RCCE	H	031000010
		RCCJ	CCF		
		RCCJ	KAD		
WING POSITION TRANSMITTER	51622	RCCJA			A
AILERON POSITION INDICATOR	51621	RCCJB			A
*LEFT WING CONTROL SURFACES		LCCA	LCCB	CC	096666690
		LCCA	LCCC		
		LCCA	LCCD		
LEFT AILERON ASSEMBLY	14210	LCCAA			A
LEFT INBOARD SPOILER ASSY	14240	LCCAB			2
LEFT OUTBOARD SPOILER ASSY	14240	LCCAC			2
*AILERON DAMPING		LCCD	KEA	LCCA	062222260
DAMPER CYLINDER ASSY	14221	LCCDA			A
RELIEF VALVE	14229	LCCDB			A
*SPOILER POSITIONING		LCCB	LCCE	LCCA	021111120
		LCCB	KEA		
		LCCB	KCA		
INBOARD SPOILER PWR CYL	14252	LCCBA			A
OUTBOARD SPOILER PWR CYL	14252	LCCBB			A
SPOILER FOLLOW UP ROD ASSY	1425*	LCCBBA			A
FOLLOW UP TORQUE TUBE ASSY	1425*	LCCBBB			A
LATERAL CONTROL ROD ASSY	1425*	LCCBBC			A
DUAL SERVO VALVE	14253	LCCBBD			A
*AILERON POSITIONING		LCCC	LCCE	LCCA	096666690
		LCCC	LCDC		
		LCCC	KEA		
		LCCC	KCA		
AILERON POWER CONTROL CYL	14222	LCCCA			A
LAT CTRL BELLCRANK ASSY	14225	LCCCB			A
LAT CTRL ROD ASSY	1421B	LCCCC			A
*MECHANICAL LINKAGE		LCCE	LCCF	LCCC	AAAAAAAAA
		LCCE	LCCG	LCCJ	AAAAAAAAA
		LCCE	CF	LCCB	AAAAAAAAA
WALKING BEAM BELLCRANK	14271	LCCEA			A
IDLER ASSY	14272	LCCEC			A
LATERAL CONTROL LINKAGE	14270	LCCED			A
*FEEL FORCE AND FEEL TRIM		LCCF	CCH	CCH	072222270
		LCCF	KAA	CCE	AAAAAAAAA
		LCCF		CBX	AAAAAAAAA
CARTRIDGE JACK ACTUATOR	14262	LCCFA			A
TRIM ROTARY ACTUATOR	14261	LCCFB			A
FLEX DRIVE CABLE	14266	LCCFC			A
ELECTRICAL CONTROL	14269	LCCFD			A
ARI POSITION TRANSDUCER	5162R	LCCFE			A
*ROLL TRANSMISSION		LCC6	CCH	LCCE	096666690
OVERRIDE SPRING CARTRIDGE	14223	LCC6A			A
LINKAGE	14119	LCC6B			A
*AILERON POSITION TRANSMIT		LCCJ	LCCF	H	030000010
		LCCJ	LCCE		
		LCCJ	KAD		
WING POSITION TRANSMITTER	51622	LCCJA			A
AILERON POSITION INDICATOR	51621	LCCJB			A
*ROLL AND TRIM INITIATE		CCH	LCCF	LCCF	F099999990
		CCH	RCCF	RCCF	F099999990
		CCH	CAZ	LCC6	FAAAAAAAAA
		CCH	KBA	RCC6	FAAAAAAAAA
		CCH		CC	SAAAAAAAAA
LATERAL TORQUE TUBE	1411B	CCHA			A
CONTROL STICK ASSY	14110	CCHB			A
TRIM SWITCH	14115	CCHC			A
*MODE SELECT		CAZ	L	CCH	AAAAAAAAA
LIFT AUGMENTATION		CD	CDA	C	040000270
		CD	CDB		
		CD	CDC		

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BOUNDARY LAYER CONTROL		CDA	RCDAA	CD	0000000440
		CDA	LCDAA		
*RIGHT BOUNDARY LAYER AIR		RCDAA	RCDAAA	CDA	AAAAAAAAA
		RCDAA	RCDAAB	CDAE	AAAAAAAAA
		RCDAA	RCDAAC		
		RCDAA	BAH		
*RIGHT TE BOUNDARY LAYER SYS		RCDAAA	RCDAB	RCDAA	080000880
DUCT	41541	RCDAAAA			A
SHUTOFF VALVE	41542	RCDAAAB			A
TE INDICATOR	51731	RCDAAAC			1
TE TRANSMITTER	51714	RCDAAAD			1
SHUTOFF VALVE SWITCH	41547	RCDAAAE			A
CLAMP	41546	RCDAAAF			A
SEAL	41548	RCDAAAG			A
OUTLET NOZZLE	4154A	RCDAAAH			A
TE POSITION SWITCH	41548	RCDAAAJ			A
*RIGHT LE CENTER WING SYSTEM		RCDAAC	RCDAD	RCDAA	080000880
W/F BLC BELLOWS	41521	RCDAACA			A
INNER OUTBOARD CHAMBER	41522	RCDAACB			A
CENTER CHAMBER	41523	RCDAACC			A
INNER CHAMBER	41524	RCDAACD			A
OUTBOARD CHAMBER	41525	RCDAACE			A
CLAMP	41526	RCDAACF			A
COUPLING	41527	RCDAACG			A
FLEXIBLE SEAL	41528	RCDAACH			A
LE INDICATOR	52711	RCDAACJ			1
LE TRANSMITTER	51712	RCDAACK			1
*RIGHT LE OUTER WING SYSTEM		RCDAAB	RCDAC	RCDAA	080000880
BELLOWS ASSY	41531	RCDAABA			A
DUCT	41532	RCDAABB			A
LE CUTOFF VALVE	41533	RCDAABC			A
CLAMP	41534	RCDAABD			A
COUPLING	41535	RCDAABE			A
FLEXIBLE SEAL	41536	RCDAABF			A
SHUTOFF VALVE SWITCH	41537	RCDAABG			A
SHUTOFF VALVE LINK	41538	RCDAABH			A
*RIGHT TE BNDRY AIR INITIATE		RCDAB	RCDBBD	RCDAAA	AAAAAAAAA
*RIGHT LE CENTER AIR INITIAT		RCDAC	RCDBBA	RCDAAC	AAAAAAAAA
*RIGHT LE OUTBRD AIR INITIAT		RCDAD	RCDBBC	RCDAAB	AAAAAAAAA
*LEFT BOUNDARY LAYER AIR		LCDAA	LCDAAA	CDA	AAAAAAAAA
		LCDAA	LCDAAB	CDAE	AAAAAAAAA
		LCDAA	LCDAAC		
		LCDAA	BAG		
*LEFT TE BOUNDARY LAYER SYS		LCDAAA	LCDAB	LCDAA	080000880
DUCT	41541	LCDAAAA			A
SHUTOFF VALVE	41542	LCDAAAB			A
TE INDICATOR	51731	LCDAAAC			1
TE TRANSMITTER	51714	LCDAAAD			1
SHUTOFF VALVE SWITCH	41547	LCDAAAE			A
CLAMP	41546	LCDAAAF			A
SEAL	41548	LCDAAAG			A
OUTLET NOZZLE	4154A	LCDAAAH			A
TE POSITION SWITCH	41548	LCDAAAJ			A
*LEFT LE CENTER WING SYSTEM		LCDAAC	LCDAD	LCDAA	080000880
W/F BLC BELLOWS	41521	LCDAACA			A
INNER OUTBOARD CHAMBER	41522	LCDAACB			A
CENTER CHAMBER	41523	LCDAACC			A
INNER CHAMBER	41524	LCDAACD			A
OUTBOARD CHAMBER	41525	LCDAACE			A
CLAMP	41526	LCDAACF			A
COUPLING	41527	LCDAACG			A
FLEX SEAL	41528	LCDAACH			A
LE INDICATOR	52711	LCDAACJ			1
LE TRANSMITTER	51712	LCDAACK			1
*LEFT LE OUTER WING SYSTEM		LCDAAB	LCDAC	LCDAA	080000880
BELLOWS ASSY	41531	LCDAABA			A
DUCT	41532	LCDAABB			A
LE CUTOFF VALVE	41533	LCDAABC			A
CLAMP	41534	LCDAABD			A
COUPLING	41535	LCDAABE			A
FLEXIBLE SEAL	41536	LCDAABF			A
SHUTOFF VALVE SWITCH	41537	LCDAABG			A
SHUTOFF VALVE LINK	41538	LCDAABH			A
*LEFT TE BNDRY AIR INITIATE		LCDAB	LCDBBD	LCDAAA	AAAAAAAAA
*LEFT LE CNTR AIR INITIATE		LCDAC	LCDBBA	LCDAAB	AAAAAAAAA
*LEFT LE OUTBRD AIR INITIATE		LCDAD	LCDBBC	LCDAAC	AAAAAAAAA
*BOUNDARY LAYER WARNING		CDAE	RCDAA	H	AAAAAAAAA
		CDAE	LCDAA		
		CDAE	KAE		
		CDAE	CDB		

MALFUNCTION LIGHT	41551	CDAEA			A	
LIMIT SWITCH	41552	CDAEB			A	
*FLAP CONTROL SYSTEM	14500	CDB	CDBA	CD		070000770
		CDB		CDAE		AAAAAAAAA
*CONTROL SURFACES		CDBA	CDBB	CDB		AAAAAAAAA
		CDBA	CDBE			
LE LEFT OUTBOARD FLAP	14530	LCDBAA	LCDBBA	CDBA		AAAAAAAAA
		LCDBAA	LCDBE			
LE RIGHT OUTBOARD FLAP	14530	RCDBAA	RCDBBA	CDBA		AAAAAAAAA
		RCDBAA	RCDBE			
LE CENTER LEFT FLAP	14520	LCDBAB	LCDBBB	CDBA		AAAAAAAAA
		LCDBAB	LCDBE			
LE CENTER RIGHT FLAP	14520	RCDBAB	RCDBBB	CDBA		AAAAAAAAA
		RCDBAB	RCDBE			
LE INBOARD LEFT FLAP	14510	LCDBAC	LCDBBC	CDBA		AAAAAAAAA
		LCDBAC	LCDBE			
LE INBOARD RIGHT FLAP	14510	RCDBAC	RCDBBC	CDBA		AAAAAAAAA
		RCDBAC	RCDBE			
TE LEFT FLAP	14540	LCDBAD	LCDBBD	CDBA		AAAAAAAAA
		LCDBAD	LCDBE			
TE RIGHT FLAP	14540	RCDBAD	RCDBBD	CDBA		AAAAAAAAA
		RCDBAD	RCDBE			
*HYDRAULIC ACTUATION OF FLAP		CDBB	CDBC	CDBA	CDBE	555555555
*HYD ACT LE LEFT OUTBOARD		LCDBBA	LCDBCA	LCDBAA		AAAAAAAAA
		LCDBBA		LCDAC		AAAAAAAAA
ACTUATING CYLINDER	14558	LCDBBAA			A	
ONE WAY RESTRICTOR VALVE	1455*	LCDBBAB			A	
SHUTTLE VALVE	1455*	LCDBBAC			A	
ONE WAY RESTRICTOR	1455*	LCDBBAD			A	
*HYD ACT LE RIGHT OUTBOARD		RCDBBA	CDBCA	RCDBAA		AAAAAAAAA
		RCDBBA		RCDAC		AAAAAAAAA
ACTUATING CYLINDER	14558	RCDBBAA			A	
ONE WAY RESTRICTOR VALVE	1455*	RCDBBAB			A	
SHUTTLE VALVE	1455*	RCDBBAC			A	
ONE WAY RESTRICTOR	1455*	RCDBBAD			A	
*HYD ACT LE CENTER LEFT		LCDBBB	CDBCB	LCDBAB		AAAAAAAAA
ACTUATING CYLINDER	14557	LCDBBBA			A	
ONE WAY RESTRICTOR	1455*	LCDBBBB			A	
SHUTTLE VALVE	1455*	LCDBBBC			A	
ONE WAY RESTRICTOR	1455*	LCDBBBD			A	
*HYD ACT LE CENTER RIGHT		RCDBBB	CDBCB	RCDBAB		AAAAAAAAA
ACTUATING CYLINDER	14557	RCDBBBA			A	
ONE WAY RESTRICTOR	1455*	RCDBBBB			A	
SHUTTLE VALVE	1455*	RCDBBBC			A	
ONE WAY RESTRICTOR	1455*	RCDBBBD			A	
*HYD ACT LE INBOARD LEFT		LCDBBC	CDBCC	LCDBAC		AAAAAAAAA
		LCDBBC		LCDAD		AAAAAAAAA
ACTUATING CYLINDER	14556	LCDBBCA			A	
ONE WAY RESTRICTOR	1455*	LCDBBCB			A	
SHUTTLE VALVE	1455*	LCDBBCC			A	
ONE WAY RESTRICTOR	1455*	LCDBBCD			A	
*HYD ACT LE INBOARD RIGHT		RCDBBC	CDBCC	RCDBAC		AAAAAAAAA
		RCDBBC		RCDAD		AAAAAAAAA
ACTUATING CYLINDER	14556	RCDBBCA			A	
ONE WAY RESTRICTOR	1455*	RCDBBCB			A	
SHUTTLE VALVE	1455*	RCDBBCC			A	
ONE WAY RESTRICTOR	1455*	RCDBBC			A	
*HYDRAULIC DISTRIBUTION		CDBC	KEA	CDBCA		AAAAAAAAA
		CDBC		CDBCB		AAAAAAAAA
		CDBC		CDBCC		AAAAAAAAA
HYD DIST LE FLAPS		CDBCA	CDBD	CDBB		AAAAAAAA
		CDBCA		CDD		AAAAAAAA
HYD SOLENOID SELECTOR VALVE	14552	CDBCAA			A	
ONE WAY RESTRICTOR VALVE	1455*	CDBCAB			A	
DUMP VALVE OVERBOARD DRAIN	1455H	CDBCAC			A	
*HYD ACTUATION LEFT TE FLAP		LCDBBD	CDBCB	LCDBAD		AAAAAAAAA
		LCDBBD	CDBCC	LCDAB		AAAAAAAAA
ACTUATING CYLINDER	14555	LCDBBDA			A	
SHUTTLE VALVE	1455*	LCDBBDB			A	
*HYD ACTUATION RIGHT TE FLAP		RCDBBD	CDBCB	RCDBAD		AAAAAAAAA
		RCDBBD	CDBCC	RCDAB		AAAAAAAAA
ACTUATING CYLINDER	14555	RCDBBDA			A	
SHUTTLE VALVE	1455*	RCDBBDB			A	
*HYD DIST TE FLAP HALF DWN		CDBCB	CDBD	CDD		AAAAAAAAA
		CDBCB		LCDBBD		AAAAAAAAA
		CDBCB		RCDBBD		AAAAAAAAA
HYD FLOW DIVIDER	14553	CDBCBA			A	
ONE WAY RESTRICTOR	1455*	CDBCBB			A	
ONE WAY RESTRICTOR	1455*	CDBCAB			A	
HYD SOL SELECTOR VALVE	14552	CDBCAA			A	

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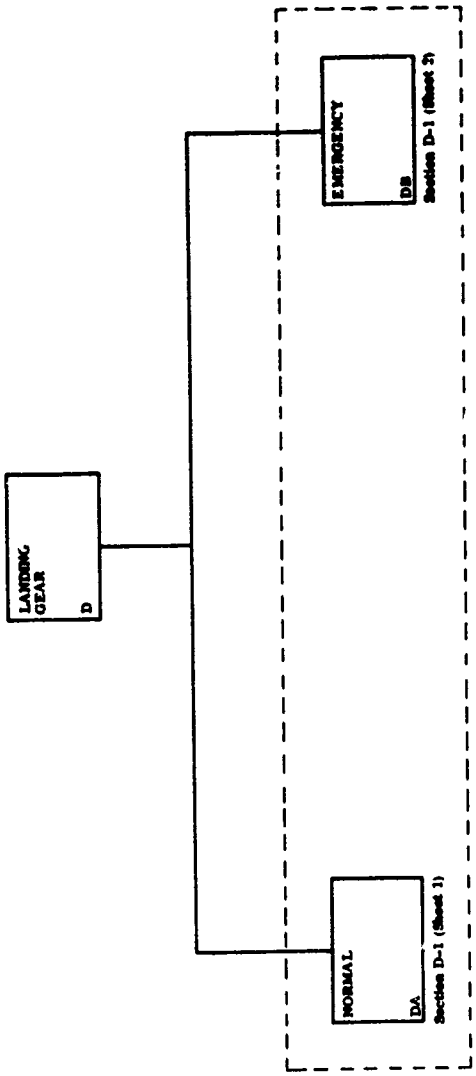
*HYD DIST TE FLAP FULL DOWN		CDBCC	CDBD	CDD			AAAAAAAAA
		CDBCC		LCDBBD			AAAAAAAAA
		CDBCC		RCDBBD			AAAAAAAAA
HYD FLOW DIVIDER	14553	CDBCCA				A	
ONE WAY RESTRICTOR	1455*	CDBCCB				A	
ONE WAY RESTRICTOR	1455*	CDBCCC				A	
HYD SOLENOID SELECTOR VALVE	14552	CDBCCD				A	
*ELECTRICAL CONTROL		CDBD	CDB6	CDBC			AAAAAAAAA
		CDBD	KBB	CDBF			AAAAAAAAA
RT OUTBOARD LE UP LIMIT SW	1455F	CDBDA				1	
LEFT OUTBRD LE UP LIMIT SW	1455F	CDBDB				1	
RT INBOARD LE UP LIMIT SW	1455F	CDBDC				1	
LEFT INBOARD LE UP LIMIT SW	1455F	CDBDC				1	
RT CENTER LE UP LIMIT SW	1455F	CDBDE				1	
LEFT CENTER LE UP LIMIT SW	1455F	CDBDF				1	
RT TE UP LIMIT SWITCH	1455F	CDBD6				1	
LEFT TE UP LIMIT SWITCH	1455F	CDBDH				1	
RT TE HALF UP LIMIT SWITCH	1455F	CDBDJ				1	
LEFT TE HALF UP LIMIT SW	1455F	CDBDK				1	
FLAP AIRSPEED SWITCH	1455E	CDBDL				A	
*FLAP POSITION INITIATE		CDB6	L	CDBD			AAAAAAAAA
		CDB6		CDF			AAAAAAAAA
FLAP CONTROL SWITCH	1455J	CDB6A				A	
*PNEUMATIC ACTUATION OF FLAP		CDBE	CDBF	CDBA	K CDBB		000000880
LEFT OUTBRD ACTUATING CYL	14558	LCDBBAA				A	
RIGHT OUTBRD ACTUATING CYL	14558	RCDBBAA				A	
LEFT CENTER ACTUATING CYL	14557	LCDBBBA				A	
RIGHT CENTER ACTUATING CYL	14557	RCDBBBA				A	
LEFT INBOARD ACTUATING CYL	14556	LCDBBCA				A	
RIGHT INBOARD ACTUATING CYL	14556	RCDBBCA				A	
LEFT TE ACTUATING CYLINDER	14555	LCDBBDA				A	
RIGHT TE ACTUATING CYLINDER	14555	RCDBBDA				A	
*PNEUMATIC DISTRIBUTION		CDBF	CDBH	CDBE			AAAAAAAAA
		CDBF	KGA				
LE OUTBRD LEFT SHUTTLE VLV	1455*	LCDBBAC				A	
LE OUTBRD RIGHT SHUTTLE VLV	1455*	RCDBBAC				A	
LE INBRD LEFT SHUTTLE VALVE	1455*	LCDBBCC				A	
LE INBRD RIGHT SHUTTLE VLV	1455*	RCDBBCC				A	
LE CENTER LEFT SHUTTLE VLV	1455*	LCDBBBC				A	
LE CENTER RIGHT SHUTTLE VLV	1455*	RCDBBBC				A	
TE RIGHT SHUTTLE VALVE	1455*	RCDBBDB				A	
TE LEFT SHUTTLE VALVE	1455*	LCDBBDB				A	
CROSS FITTING	1455*	CDBFA				A	
EMER FLAP AIR SELECTOR VLV	1455*	CDBFB				A	
PNEUMATIC CHECK VALVE	1455*	CDBFC				A	
PNEUMATIC CSREENED FITTING	1455*	CDBFD				A	
EMER FLAP AIR PRESSURE GAGE	1455*	CDBFE				1	
RELIEF VALVE	1455*	CDBFF				A	
EMERGENCY FLAP AIR BOTTLE	1455*	CDBF6				A	
PNEUMATIC CHECK VALVE	1455*	CDBFH				A	
*FLAP EMER POSITION INITIATC		CDBH	L	CDBF			AAAAAAAAA
*FLAP POSITION INDICATE		CDBJ	KBA	H			050000350
		CDBJ	KAE				
		CDBJ	CDBA				
POSITION TRANSMITTER	51628	CDBJA				A	
POSITION INDICATOR	51627	CDBJB				A	
*AILERON DROOP HYDRAULIC		CDC	LCDC	CD			070000770
		CDC	RCDC				
*LEFT AILERON DROOP		LCDC	CDD	LCCC			AAAAAAAAA
		LCDC		CDC			AAAAAAAAA
DROOP CYLINDER	14224	LCDCA				A	
*RIGHT AILERON DROOP		RCDC	CDD	RCCC			AAAAAAAAA
		RCDC		CDC			AAAAAAAAA
DROOP CYLINDER	14224	CDCA				A	
*DROOP ACTUATE		CDD	CDBCA	LCDC			FAAAAAAAAA
		CDD	CDBB	RCDC			FAAAAAAAAA
		CDD		CDC			SAAAAAAAAA
HYDRAULIC CHECK VALVE	1422*	CDDA				A	
MANUAL HYDRAULIC BYPASS VLV	1422*	CDDB				A	
2 WAY RESTRICTOR	1422*	CDDC				A	
HYDRAULIC FILTER	1422*	CDDE				A	
*AILERON DROOP ELECTRICAL		CDE	LCDE	CD			070000770
		CDE	RCDE				
*LEFT AILERON DROOP		LCDE	CDF	LCCC			AAAAAAAAA
		LCDE		CDE			AAAAAAAAA
ELECTRICAL DROOP ACTUATOR	1422E	LCDEA				A	
*RIGHT AILERON DROOP		RCDE	CDF	RCCC			AAAAAAAAA
		RCDE		CDE			AAAAAAAAA
ELECTRICAL DROOP ACTUATOR	1422E	RCDEA				A	

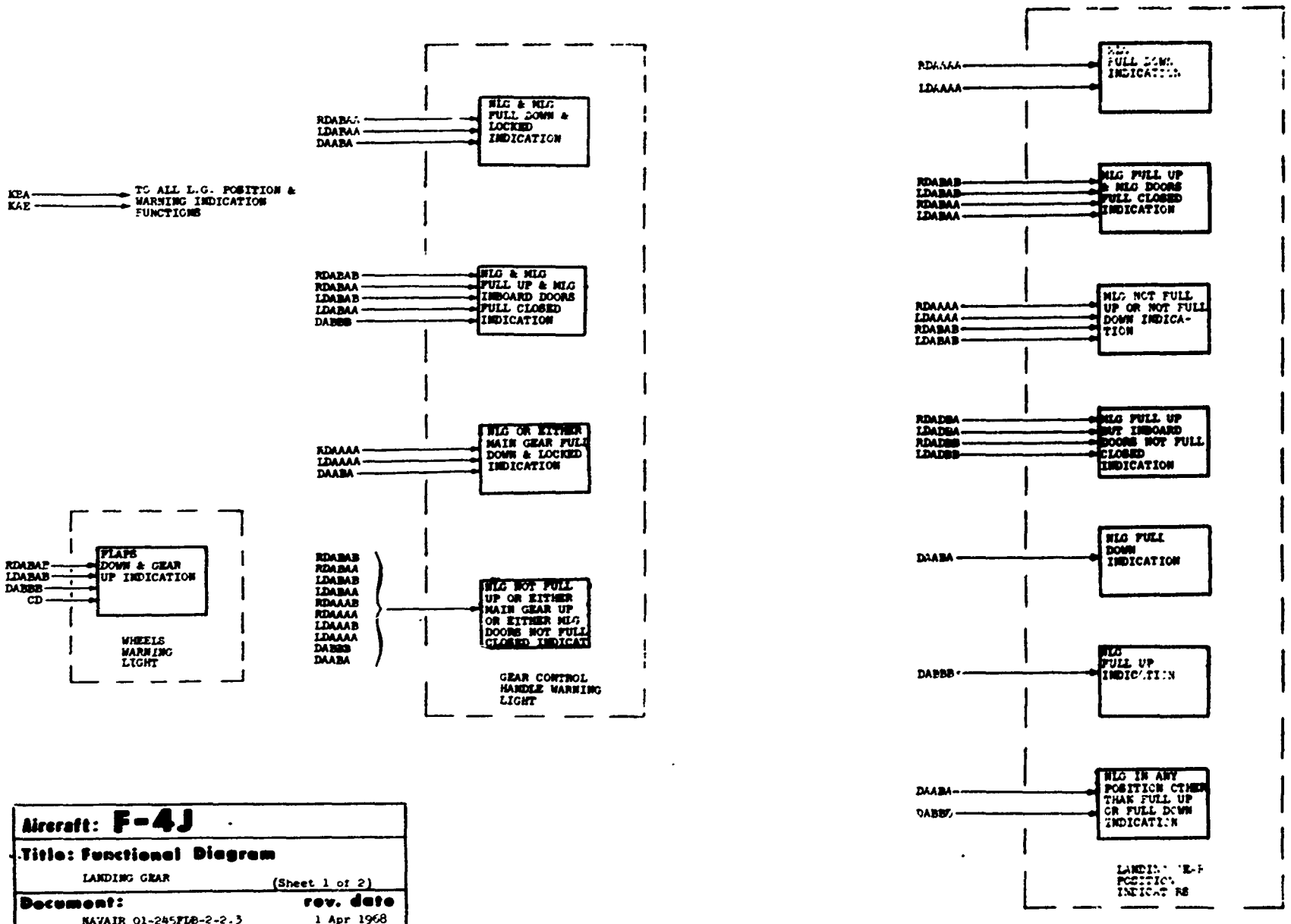
	•DROOP ACTUATE		CDF	CD96	RCDE		FAAAAAAAAA
			CDF		LCDE		FAAAAAAAAA
			CDF		CDE		SAAAAAAAAA
	DROOP AIL EXTEND RELAY	1422•	CDFA			A	
	•SPEED CONTROL AIR	9	CE	LCEA	C		000033660
02		9	CE	RCEA			
	•LEFT SPEED BRAKE	9	LCEA	CEB	CE		AAAAAAAAA
		9	LCEA		LCEJ		AAAAAAAAA
05	SPEED BRAKE ASSEMBLY	914610	LCEAA			A	
06	HONEYCOMB SKIN	914611	LCEAB			5	
07	SPEED BRAKE CYLINDER	914623	LCEAC			A	
	•RIGHT SPEED BRAKE	9	RCEA	CEB	CE		AAAAAAAAA
		9	RCEA		RCEJ		AAAAAAAAA
10	SPEED BRAKE ASSEMBLY	914610	RCEAA			A	
11	HONEYCOMB SKIN	914611	RCEAB			5	
12	SPEED BRAKE CYLINDER	914623	RCEAC			A	
	SPEED BRAKE ACTUATION	9	CEB	CEC	LCEA		FAAAAAAAAA
		9	CEB		RCEA		FAAAAAAAAA
			CEB		CE		SAAAAAAAAA
15	FLOW DIVIDER	9	CEBA			A	
	•HYDRAULIC ACTUATION	9	CEC	CED	CEB		AAAAAAAAA
17		9	CEC	CEE			
18		9	CEC	CEF			
19		9	CEC	KEA			
20	SPEED BRAKE SELECTOR VALVE	914621	CECA			A	
21	HYDRAULIC CHECK VALVE	91462•	CECB			A	
	•NORMAL EXTEND	9	CED	CEG	CEC		AAAAAAAAA
24	SPEED BRAKE CONTROL SWITCH	914627	CEDA			A	
25	MANUAL RETRACT SWITCH	91462A	CEFA			A	
26	SPEED BRAKE CIRCUIT BREAKER	91462•	CEGA			A	
	•NORMAL RETRACT	9	CEE	CEG	CEC		000111130
28	SPEED BRAKE CONTROL SWITCH	914627	CEDA			A	
29	MANUAL RETRACT SWITCH	91462A	CEFA			A	
30	SPEED BRAKE CIRCUIT BREAKER	91462•	CEGA			A	
31	SPEED BRAKE RETRACT RELAY	91462•	CEEA			A	
	•EMERGENCY RETRACT	9	CEF	CEG	CEC	K CEF	0522222b0
33	MANUAL RETRACT SWITCH	91462A	CEFA			A	
	•ELECTRICAL CONTROL	9	CEG	KRB	CED		FAAAAAAAAA
		9	CEG	CEH	CEE		FAAAAAAAAA
		9	CEG		CEF		FAAAAAAAAA
			CEG		CEC		SAAAAAAAAA
	SPEED BRAKE INITIATE	9	CEH	L	CEG		053111250
	•SPEED BRAKE POSIT IND LEFT	9	LCEJ	LCEA	CEK		AAAAAAAAA
		9	LCEJ	KEA			
39	LEFT SPEED BRAKE POSIT SW	91462•	LCEJA			A	
40	RETRACT LIMIT SWITCH	91462B	LCEJB			A	
	•SPEED BRAKE POSIT IND RIGHT	9	RCEJ	RCEA	CEK		AAAAAAAAA
		9	RCEJ	KEA			
42	RIGHT SPEED BRAKE POSIT SW	91462•	RCEJA			A	
43	RETRACT LIMIT SWITCH	91462B	RCEJB			A	
	•WARNING INDICATE	9	CEK	RCEJ	H		011111110
44		9	CEK	LCEJ			
		9	CEK	KAE			
45	SPEED BRAKE WARNING LIGHTS	914631	CEKA			A	
46	WARN LIGHTS SAMP FUSE	91463•	CEKB			A	
	GUIDANCE AND FLT CONTRL SYS	A	CF	ECJ	CAB		001101100
		A	CF		CHB		001101100
		A	CF		RCCE		001101100
		A	CF		LCCE		001101100
			CF		RBFC		AAAAAAAAA
			CF		LBFC		AAAAAAAAA
			CF		RBABC		AAAAAAAAA
			CF		LBABC		AAAAAAAAA
			CF		HUD		AAAAAAAAA
			CF		BGHD		AAAAAAAAA
02	MOTIONAL PICKUP TRANSDUCER	A57112	CFA			A	
03	ENGAGING CONTROLLER	A5711L	CFB			A	
04	PITCH RATE GYRO	A57116	CFC			A	
05	ROLL RATE GYRO	A5711B	CFD			A	
06	YAW RATE GYRO	A57115	CFE			A	
07	LATERAL ACCELEROMETER	A57117	CFF			A	
08	G LIMITING ACCELEROMETER	A5711A	CFG			A	
09	CONTROL AMPLIFIER	A5711400	CFH			A	
10	AUTOPILOT COUPLER	A5711F	CFJ			A	
11	LATERAL SERIES SERVO ACT	A14251	RCFK			A	
12	LATERAL SERIES SERVO ACT	A14251	LCFK			A	
13	AUTOPILOT WARNING LIGHT	A5711•	CFL			2	
14	AUTOPILOT DISENAGE WARN LT	A5711•	CFM			2	
15	PITCH AUG OFF WARNING LT	A5711•	CFN			2	

D. LANDING GEAR SECTION



Aircraft: F-4J	
Title: Functional Diagram LANDING GEAR SECTION	
Document: NA	rev. date NA
Date: 22 Apr 1969	

Section D



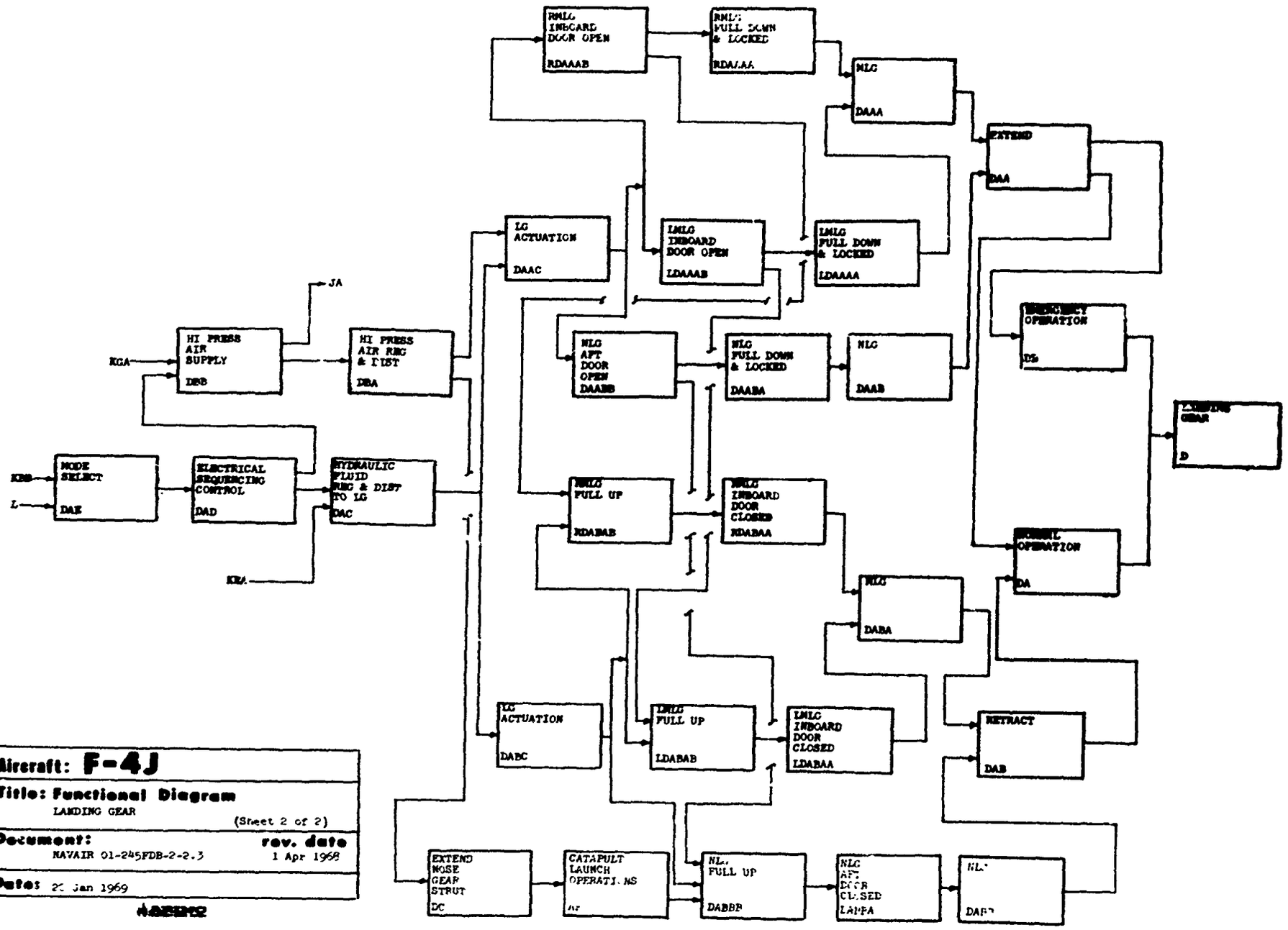
Aircraft: F-4J

Title: Functional Diagram

LANDING GEAR (Sheet 1 of 2)

Document: NAVAIR 01-245FLB-2-2.3 **rev. date** 1 Apr 1968

Date: [illegible]



Aircraft: F-4J

Title: Functional Diagram
LANDING GEAR
(Sheet 2 of 2)

Document: NAVAIR 01-245FDB-2-2.3
rev. date 1 Apr 1968

Date: 20 Jan 1969

Section D-1 (Sheet 2)

	TITLE	WUC	ALPHA	INPUT	DEP FUNC	CD FC	AL FN	SENSITIVITY W 12 3456789
00	LANDING GEAR	B	D	DAA				0100000A0
00		B	D	DAB				
01	EXTEND LANDING GEAR	B	DAA	DAAA	D			0000000A0
			DAA	DAAB				
03	EXTEND MAIN LANDING GEAR	B	DAAA	RDAAAA	DAA			AAAAAAAAA
04		B	DAAA	LDAAAA				
05	RMLG FULL DOWN AND LOCKED	B	RDAAAA	RDAAAB	DAAA			AAAAAAAAA
07	RMLG SHOCK STRUT	B13211	RDAAAAA				A	
08	RMLG SHRINK MECHANISM	B13212	RDAAAAB				5	
09	RMLG DOWN LIMIT SWITCH	B13142	RDAAAAC				1	
10	RMLG UPLOCK ONEWAY RESTRICT	B13216	RDAAAAD				5	
11	RMLG SIDEBRACE ACTUATOR	B1321D	RDAAAAE				A	
12	RMLG UPLOCK SEQ VALVE ASSY	B13215	RDAAAAF				A	
13	RMLG UPLK + INBD DR SHT VLV	B13214	RDAAAAG				A	
14	RMLG UPLOCK MECHANISM	B13217	RDAAAAH				A	
15	RMLG SIDEBRC ACT ONEWY RSTR	B1321*	RDAAAAJ				5	
16	RMLG UPLOCK ACTUATOR	B1321*	RDAAAAK				A	
17	RMLG WHEEL + TIRE ASSY	B13251	RDAAAAL				A	
18	RMLG DRAG BEAM PADS	B132**	RDAAAAM				5	
19	RMLG OUTBOARD DOOR	B13235	RDAAAAN				5	
	RMLG STRUT DOOR	B13234	RDAAAAP				5	
	RMLG SCISSORS SWITCH	B13145	RDAAAAQ				1	
22	LANDING GEAR DUMP VALVE	B13155	DAAAAR				1	
23	RMLG OUTBD DOOR DRIVE LINK	B1323B	RDAAAAS				A	
	*RMLG INBOARD DOOR OPEN	B	RDAAAB	DAAC	RDAAAA			AAAAAAAAA
		B	RDAAAB		H			AAAAAAAAA
		B	RDAAAB		RDABAB			AAAAAAAAA
27	RMLG INBD DR ACT ONWY RESTR	B1323*	RDAAABA				5	
28	RMLG UPLK ONEWAY RESTRICTOR	B1321*	RDAAAAD				5	
29	RMLG INBD DOOR MECHANISM	B1323*	RDAAABB				A	
30	RMLG INBD DOOR BELLCRANK	B13232	RDAAABC				A	
31	RMLG INBOARD DOOR	B13236	RDAAABD				5	
32	RMLG UPLK + INBD DR SHT VLV	B13214	RDAAAAG				A	
33	RMLG UPLOCK SEQ VALVE ASSY	B13215	RDAAAAF				A	
34	RMLG INBD DOOR ACTUATOR	B1323*	RDAAABE				A	
35	RMLG DOOR CLOSE LIMIT SW	B13141	RDAAABF				1	
	*LMLG FULL DOWN AND LOCKED	B	LDAAAA	LDAAAB	DAAA			AAAAAAAAA
		B	LDAAAA		H			AAAAAAAAA
38	LMLG SHOCK STRUT	B13211	LDAAAAA				A	
39	LMLG SHRINK MECHANISM	B13212	LDAAAAB				5	
40	LMLG DOWN LIMIT SWITCH	B13142	LDAAAAC				1	
41	LMLG UPLOCK ONEWAY RESTRICT	B13216	LDAAAAD				5	
42	LMLG SIDEBRACE ACTUATOR	B1312D	LDAAAAE				A	
43	LMLG UPLOCK SEQ VALVE ASSY	B13215	LDAAAAF				A	
44	LMLG UPLK + INBD DR SHT VLV	B13214	LDAAAAG				A	
45	LMLG UPLOCK MECHANISM	B13217	LDAAAAH				A	
46	LMLG SIDEBRC ACT ONEWY RSTR	B1321*	LDAAAAJ				5	
47	LMLG UPLOCK ACTUATOR	B1321*	LDAAAAK				A	
48	LMLG WHEEL + TIRE ASSY	B13251	LDAAAAL				A	
49	LMLG DRAG BEAM PADS	B132**	LDAAAAM				A	
50	LMLG OUTBOARD DOOR	B13235	LDAAAAN				5	
51	LMLG STRUT DOOR	B13234	LDAAAAP				5	
52	LMLG SCISSORS SWITCH	B13145	LDAAAAQ				1	
53	LANDING GEAR DUMP VALVE	B13155	DAAAAR				1	
54	LMLG OUTBD DOOR DRIVE LINK	B1323B	LDAAAAS				5	
	*LMLG INBOARD DOOR OPEN	B	LDAAAB	DAAC	LDAAAA			AAAAAAAAA
		B	LDAAAB		LDABAB			AAAAAAAAA
		B	LDAAAB		H			AAAAAAAAA
58	LMLG INBD DR ACT ONWY RESTR	B1323*	LDAAABA				5	
59	LMLG UPLK ONEWAY RESTRICTOR	B13216*	LDAAAAD				5	
60	LMLG INBD DOOR MECHANISM	B1323*	LDAAABB				A	
61	LMLG INBD DOOR BELLCRANK	B13232	LDAAABC				A	
62	LMLG INBD DOOR	B13236	LDAAABD				5	
63	LMLG UPLK + INBD DR SHT VLV	B13214	LDAAAAG				A	
64	LMLG UPLOCK SEQ VALVE ASSY	B13215	LDAAAAF				A	
65	LMLG INBD DOOR ACTUATOR	B1323*	LDAAABE				A	
66	LMLG DOOR CLOSE LIMIT SW	B13141	LDAAABF				1	
	*EXTEND NOSE LANDING GEAR	B	DAAB	DAABA	DAA			555555555
	*NLG FULL DOWN AND LOCKED	B	DAABA	DAABB	DAAB			AAAAAAAAA
		B	DAABA		H			AAAAAAAAA
70	NLG DOWN LIMIT SWITCH	B13143	DAABAA				1	
71	NLG WHEEL AND TIRE ASSY	B13331	DAABAC				A	
72	NLG UPLOCK SEQUENCE VALVE	B13312	DAABAD				A	
73	NLG SHOCK STRUT	P13313	DAABAE				A	
74	NLG DRAG BRACE ACTUATOR	.331P	DAABAG				A	
76	NLG UPLK + AFT DR SHT VLV	B13326	DAABAH				A	
	NLG UPLK ACT ONWY RESTRICTR	B13***	DAABAJ				5	
78	LANDING GEAR DUMP VALVE	B13155	DAAAAR				1	
	NLG AFT DOOR OPEN	B	DAABB	DAAC	DABBB			AAAAAAAAA
		B	DAABB		DAABA			AAAAAAAAA
		B	DAABB		H			AAAAAAAAA

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82	NLG UPLOCK ACTUATOR	B13321	DAABAG				A	
83	NLG UPLOCK MECHANISM	B1332*	DAABBA				A	
84	NLG UPLK + AFT DR SHT VLV	B13326	DAABAH				A	
85	NLG AFT DOOR	B13324	DAABBB				5	
86	NLG FOWARD DOOR	B13328	DAABBD				5	
87	NLG UPLOCK BELLCRANK	B13322	DAABBE				A	
	*LANDING GEAR ACTUATION	B	DAAC	DA	RDAAAB			FAAAAAAAAA
		B	DAAC	DB	LDAAAB			FAAAAAAAAA
		B	DAAC		DAABB			FAAAAAAAAA
			DAAC		DAA			SAAAAAAAAA
	NORMAL L GEAR OPERATE		DA	DAC	DAAC	DI'		000000050
			DA		DABC	DF		000000050
	*HYDRAU FLD REG + DIST TO LGB		DAC	DAD	DA			AAAAAAAAA
		B	DAC	KEA	ABBB			AAAAAAAAA
93	LANDING GEAR SELECTOR VALVE	B13121	DACA				A	
	TUBING	B131**	DACB				A	
95	RESTRICTOR VALVE	B13122	DACC				5	
96	ELECTRICAL SEQUENCING CNTRL	B	DAD	DAE	DAC			AAAAAAAAA
97	LANDING GEAR CIRCUIT BREAKR	B1311*	DADA				A	
98	LANDING GEAR CONTROL SWITCH	B13112	DADB				A	
99	LANDING GEAR AUX RELAY	B1311*	DADC				A	
	-MODE SELECT	B	DAE	KBB	DAD			AAAAAAAAA
A1		B	DAE	L				
A2	LANDING GEAR CONTROL HANDLE	B13111	DAEA				A	
A3	CONTROL HANDLE WARN LITE	B1311*	DAEAA				A	
A4	LANDING GEAR CONTROL SWITCH	B13112	DADB				A	
A5	RETRACT LANDING GEAR	B	DAB	DABA	D			0A0000000
A6		B	DAB	DABB				
	*RETRACT MAIN LANDING GEAR	B	DABA	RDABAA	DAB			AAAAAAAAA
A8		B	DABA	LDABAA				
	*RMLG INBOARD DOOR CLOSED	B	RDABAA	RDABAB	DABA			AAAAAAAAA
		B	RDABAA		H			AAAAAAAAA
	RMLG INBD DR ACT ONWY RESTR	B131**	RDABAAA				5	
B1	RMLG UPLOCK ONEWAY RESTRICT	B13216	RDABAAB				5	
B2	RMLG INBD DOOR MECHANISM	B1323*	RDABAAC				A	
B3	RMLG INBD DOOR BELLCRANK	B13232	RDABAAD				A	
B4	RMLG INBOARD DOOR	B13236	RDABAAE				5	
B5	RMLG UPLK + INBD DR SHT VLV	B13214	RDABAAF				A	
B6	RMLG UPLK SEQ VALVE ASSY	B13215	RDABAAG				A	
B7	RMLG INBOARD DOOR ACTUATOR	B1323*	RDABAAH				A	
B8	RMLG DOOR CLOSE LIMIT SWTCH	B13141	RDAABF				1	
	*RMLG FULL UP	B	RDABAB	RDAAAB	RDABAA			AAAAAAAAA
		B	RDABAB	DABC	H			AAAAAAAAA
C1	RMLG SHOCK STRUT	B13211	RDABABA				A	
C2	RMLG SHRINK MECHANISM	B13212	RDABABB				5	
C3	RMLG DOWN LIMIT SWITCH	B13142	RDABABC				1	
C4	RMLG UPLK ONEWAY RESTRICTOR	B13216	RDABABD				5	
C5	RMLG SIDEBRACE ACTUATOR	B1321D	RDABABE				A	
C6	RMLG SEQUENCE VALVE ASSY	B13215	RDABABF				A	
C7	RMLG UPLK + INBD DR SHT VLV	B13214	RDABABG				A	
C8	RMLG UPLOCK MECHNAISM	B13217	RDABABH				A	
C9	RMLG SIDEBRC ACT ONWY RESTR	B1321*	RDABABJ				5	
D0	RMLG UPLOCK ACTUATOR	B1321*	RDABABK				A	
D1	RMLG WHEEL + TIRE ASSY	B13251	RDABABL				A	
D2	RMLG DRAG BEAM PADS	B132**	RDABABM				5	
D3	RMLG OUTBOARD DOOR	B13235	RDABABN				5	
D4	RMLG STRUT DOOR	B13234	RDABABD				5	
D5	RMLG SCISSORS SWITCH	B13145	RDABABQ				1	
D7	LANDING GEAR DUMP VALVE	B13155	DABABR				1	
D8	RMLG OUTBOARD DR DRIVE LINK	B13237	RDABABS				A	
	*LMLG INBOARD DOOR CLOSED	B	LDABAA	LDABAB	DABA			AAAAAAAAA
		B	LDABAA		H			AAAAAAAAA
E1	LMLG INBD DR ACT ONWY RESTR	B1326*	LDABAAA				5	
E2	LMLG UPLK ONEWAY RESTRICTOR	B13216*	LDABAAB				5	
E3	LMLG INBD DOOR MECHANISM	B1323*	LDABAAC				A	
E4	LMLG INBD DOOR BELLCRANK	B13232	LDABAAD				A	
E5	LMLG INBOARD DOOR	B13236	LDABAAE				5	
E6	LMLG UPLK + INBD DR SHT VLV	B13214	LDABAAF				A	
E7	LMLG UPLK SEQ VALVE ASSY	B13215	LDABAAG				A	
E8	LMLG INBOARD ACTUATOR	B1323*	LDABAAH				A	
E9	LMLG DOOR CLOSE LIMIT SWTCH	B13141	LDABAAJ				1	
	*LMLG FULL UP	B	LDABAB	LDAAAB	LDABAA			AAAAAAAAA
		B	LDABAB	DABC	H			AAAAAAAAA
F2	LMLG SHOCK STRUT	B13211	LDABABA				A	
F3	LMLG SHRINK MECHANISM	B13212	LDABABB				5	
F4	LMLG DOWN LIMIT SWITCH	B13142	LDABABC				1	
F5	LMLG UPLK ONEWAY RESTRICTOR	B13216*	LDABABD				5	
F6	LMLG SIDEBRACE ACTUATOR	B13210	LDABABE				A	
F7	LMLG SEQUENCE VALVE ASSY	B13215	LDABABF				A	
F8	LMLG UPLK + INBD DR SHT VLV	B13214	LDABABG				A	
F9	LMLG UPLOCK MECHANISM	B13217	LDABABH				A	

60 LMLG WHEELAND TIRE ASSEMBLY	B13251	LDABABL				A		
61 LMLG DRAG BEAM PADS	B1328••	LDABABN				5		
62 LMLG OUTBOARD DOOR	B13R35	LDABABN				5		
63 LMLG STRUT DOOR	B13234	LDABABP				5		
64 LMLG SCISSORS SWITCH	B13145	LDABABQ				1		
65 LANDING GEAR DUMP VALVE	B13185	LDABABR				1		
66 OUTBOARD DOOR DRIVE LINK	B13237	LDABABS				A		
67•RETRACT NOSE LANDING GEAR	B	DABB	DABBA	DAB			010000000	
•NLG AFT DOOR CLOSED	B	DABBA	DABBB	DABB			AAAAAAAAA	
	B	DABBA		H			AAAAAAAAA	
H0 NLG UPLOCK ACTUATOR	B13321	DABBAA				A		
H1 NLG UPLOCK MECHANISM	B1332•	DABBAB				A		
H2 NLG UPLK + AFT DR SHT VALVE	B13326	DABBAC				A		
H3 NLG AFT DOOR	B13324	DABBAD				5		
H4 NLG FOWARD DOOR	B13324	DABBAG				5		
H5 NLG UPLOCK BELLCRANK	B13322	DABBAH				A		
•NOSE LANDING GEAR FULL UP	B	DABBB	DAABB	DABBA			AAAAAAAAA	
	B	DABBB	DABC	H			AAAAAAAAA	
H9 NLG DOWN LIMIT SWITCH	B13143	DAABAA				1		
J0 NLG WHEEL + TIRE ASSEMBLY	B13331	DAABAC				A		
J1 NLG UPLOCK SEQUENCE VALVE	B13312	DAABAD				A		
J2 NLG SHOCK STRUT	B13313	DAABAE				A		
J3 NLG DRAG BRACE ACTUATOR	B1331P	DAABAF				A		
J4 NLG UPLOCK ACTUATOR	B13321	DAABAG				A		
J5 NLG UPLK + AFT DR SHT VALVE	B13326	DAABAH				A		
•LANDING GEAR ACTUATION	B	DABC	DA	RDABAB			FAAAAAAAAA	
	B	DABC		LDARAB			FAAAAAAAAA	
	B	DABC		DABBB			FAAAAAAAAA	
		DABC		DAB			SAAAAAAAAA	
•CATAPULT LAUNCH OPERATIONS	C	AF	DC				AAAAAAAAA	
•EXTEND NOSE GEAR STRUT	C	DC	DCA	AF	P		070000000	
•HI PRESS AIR REG + DIST	C	DCA	DCB	DC			AAAAAAAAA	
04 NOSE GEAR EXTEND SELECT VLV	C13317	DCAA				A		
05 NOSE GEAR SHOCK STRUT	C13313	DAABAE				A		
•HI PRESS AIR SUPPLY	C	DCB	K9A	DCA	P		AAAAAAAAA	
	C	DCB	DAD					
08 400 CU IN AIR BOTTLE	C4521A	DCBA				A		
09 CHECK VALVE	C13156	DCBB				5		
10 RELIEF VALVE	C1315C	DCBC				5		
11 TUBING	C1315•	DCBD				A		
•ELECTRICAL SEQUENCING CONTL	C	DCC	DCD	DCB			AAAAAAAAA	
13 LEFT MAIN GEAR SCISSORS SW	C13145	DAAAAQ				A		
14 NOSE GEAR STRUT EXTEND RELY	C1331•	DCCB				A		
15 NOSE GEAR STRUT EXTEND SW	C1331•	DCCE				A		
18 EMERGENCY OPERATION LG	C	DB	DBA	DAAC	K DA		0000000A0	
36 HI PRESSURE AIR REG + DIST	C	DBA	DBB	DB			AAAAAAAAA	
37 LG EMER AIR SELECTOR VALVE	C13152	DBAA				A		
38 PRESSURE OPERATED DUMP VLV	C13155	DBAB				A		
39 TWO WAY RESTRICTOR	C13157	DBAC				A		
•HI PRESSURE AIR SUPPLY	C	DBB	K9A	DBA			AAAAAAAAA	
CHECK VALVE	C13156	DCBB	DBC			A		
42 RELIEF VALVE	C1315C	DCBC				A		
43 100 CU IN AIR BOTTLE	C13153	DBBC				A		
48 CHECK VALVE	C1315•	DBBD				A		
•ELECTRICAL SEQUENCING CONTL	C	DBC	DBD	DBB	K		AAAAAAAAA	
LANDING GEAR CIRCUIT BREAKR	C1311•	DADA				A		
LANDING CONTROL SWITCH	C13112	DADB				A		
•MODE SELECT	C	DBD	KBB	DBC			AAAAAAAAA	
	C	DBD	L					
LANDING GEAR CONTRO. HANDLE	C13111	DBDA				A		
LANDING GEAR CIRCUIT BREAKR	C1315•	DADA				A		

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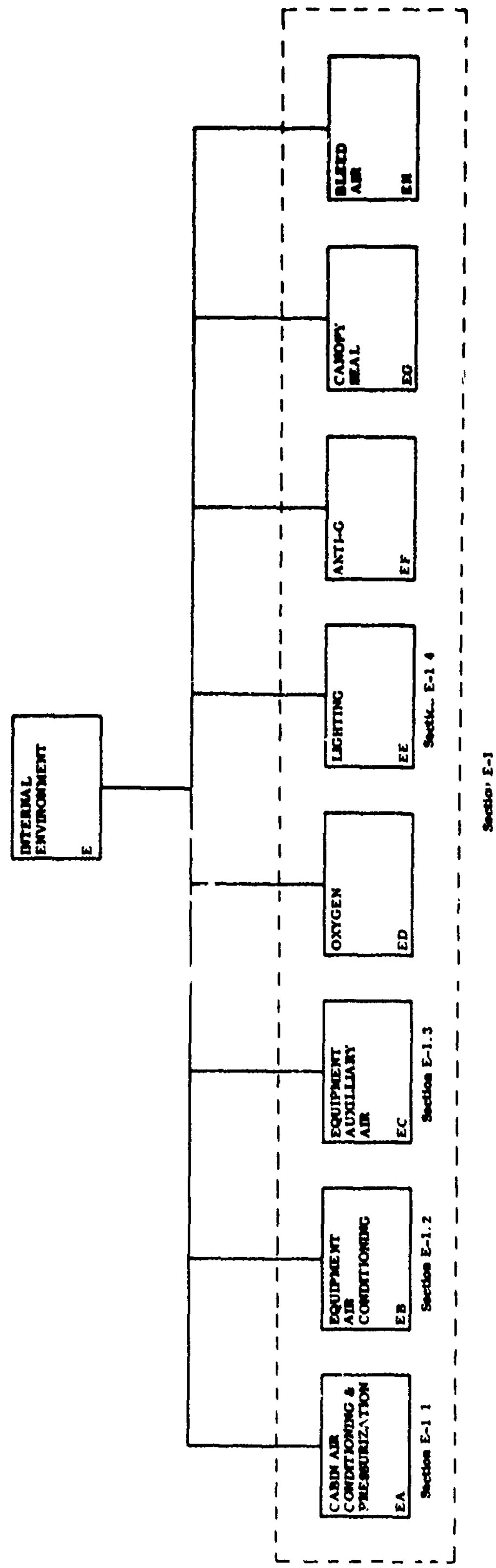
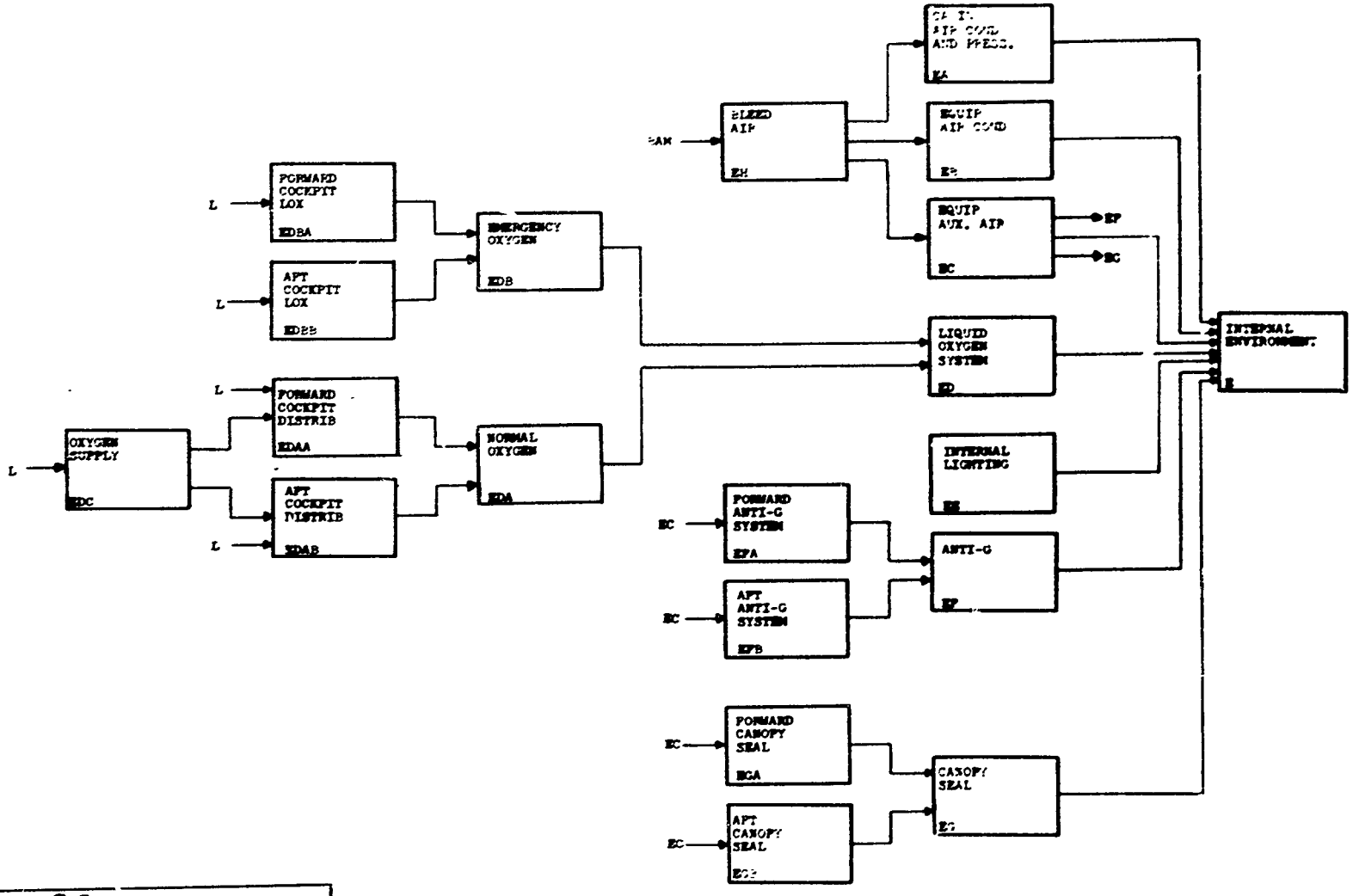
E. INTERNAL ENVIRONMENT SECTION

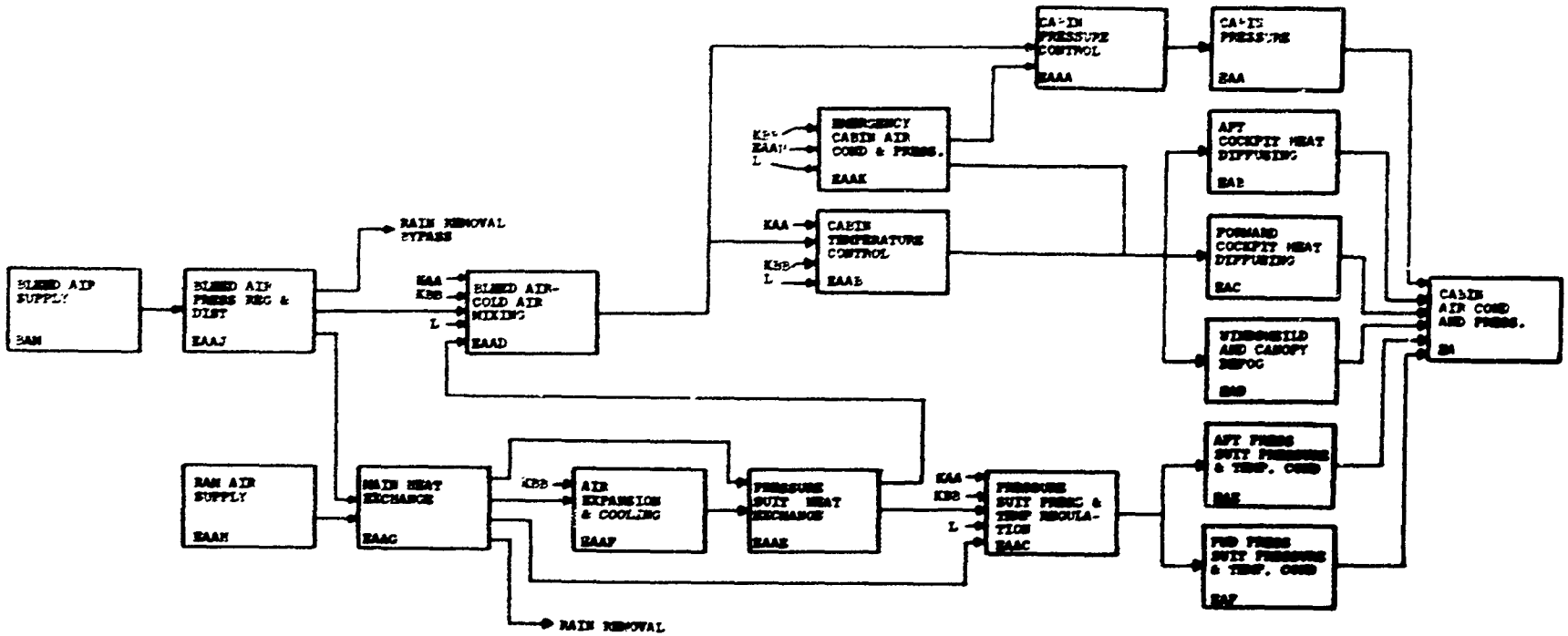


Aircraft:	F-4J
Title: Functional Diagram	INTERNAL ENVIRONMENT SECTION
Document: NA	rev. date NA
Date: 23 Apr 1980	

Section E

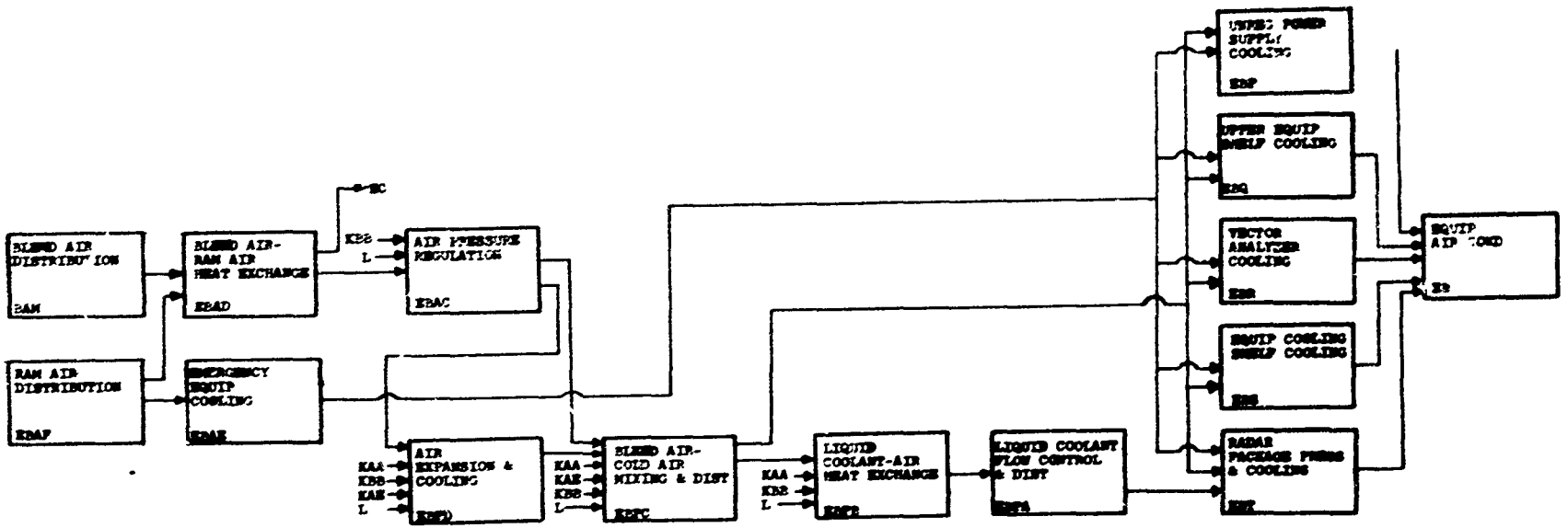


Aircraft: F-4J	
Title: Functional Diagram INTERNAL ENVIRONMENT	
Document:	**Rev. date**
NAVAIR 01-245FDE-2-2.5(1 Jun '62)	12 Mar '73
NAVAIR 01-245FDE-2-2.2(15 Mar '72)	
NAVAIR 01-245FDE-2-2.1	
Date: 23 Apr 1973	



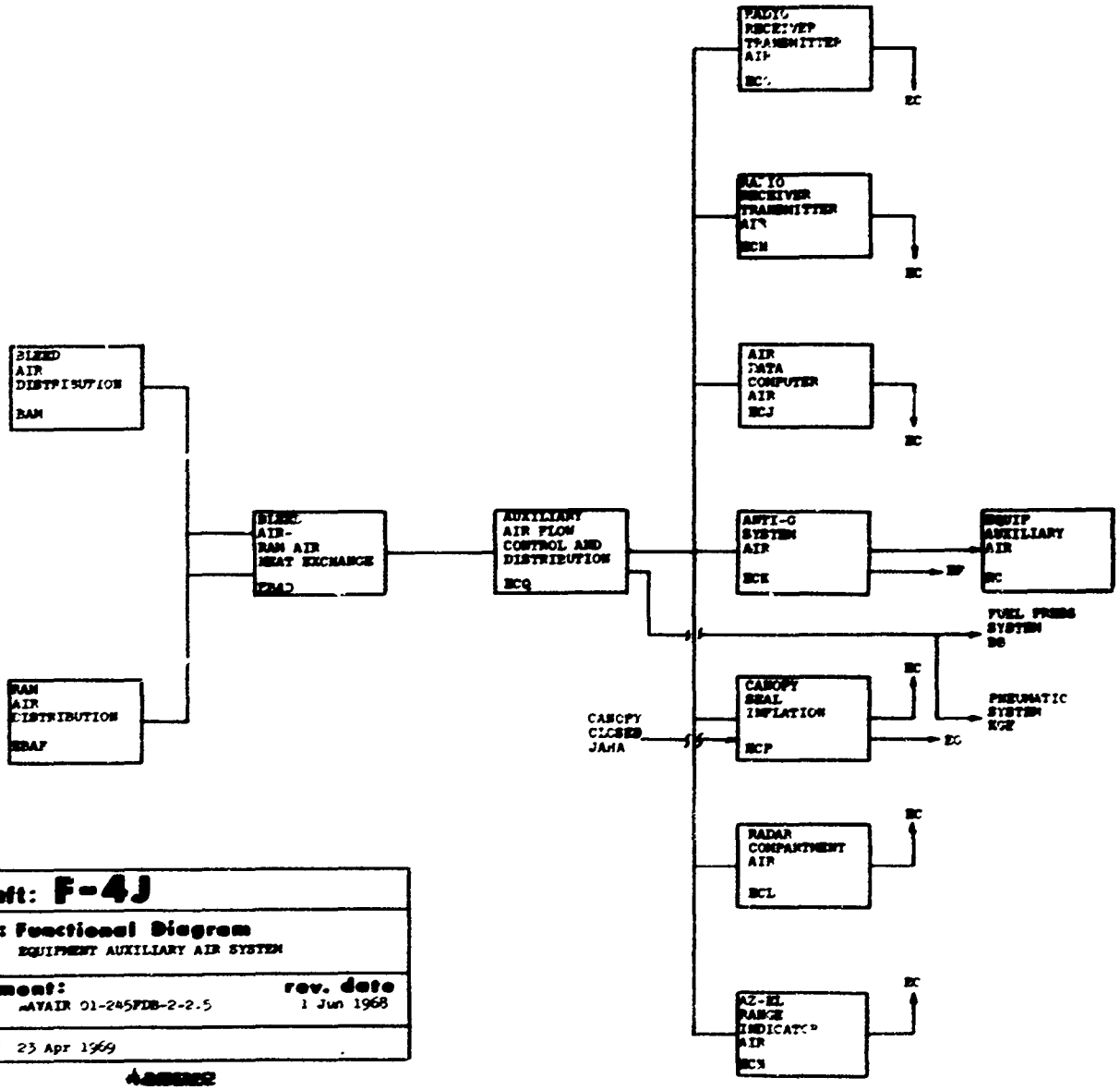
Aircraft: F-4J	
Title: Functional Diagram CABIN AIRCONDITIONING SYSTEM CABIN PRESSURE SYSTEM	
Document: NAVAIR 01-245FDD-2-2.5	**rev. date** 1 Jun 1968
Date: 23 Apr 1969	

[redacted]



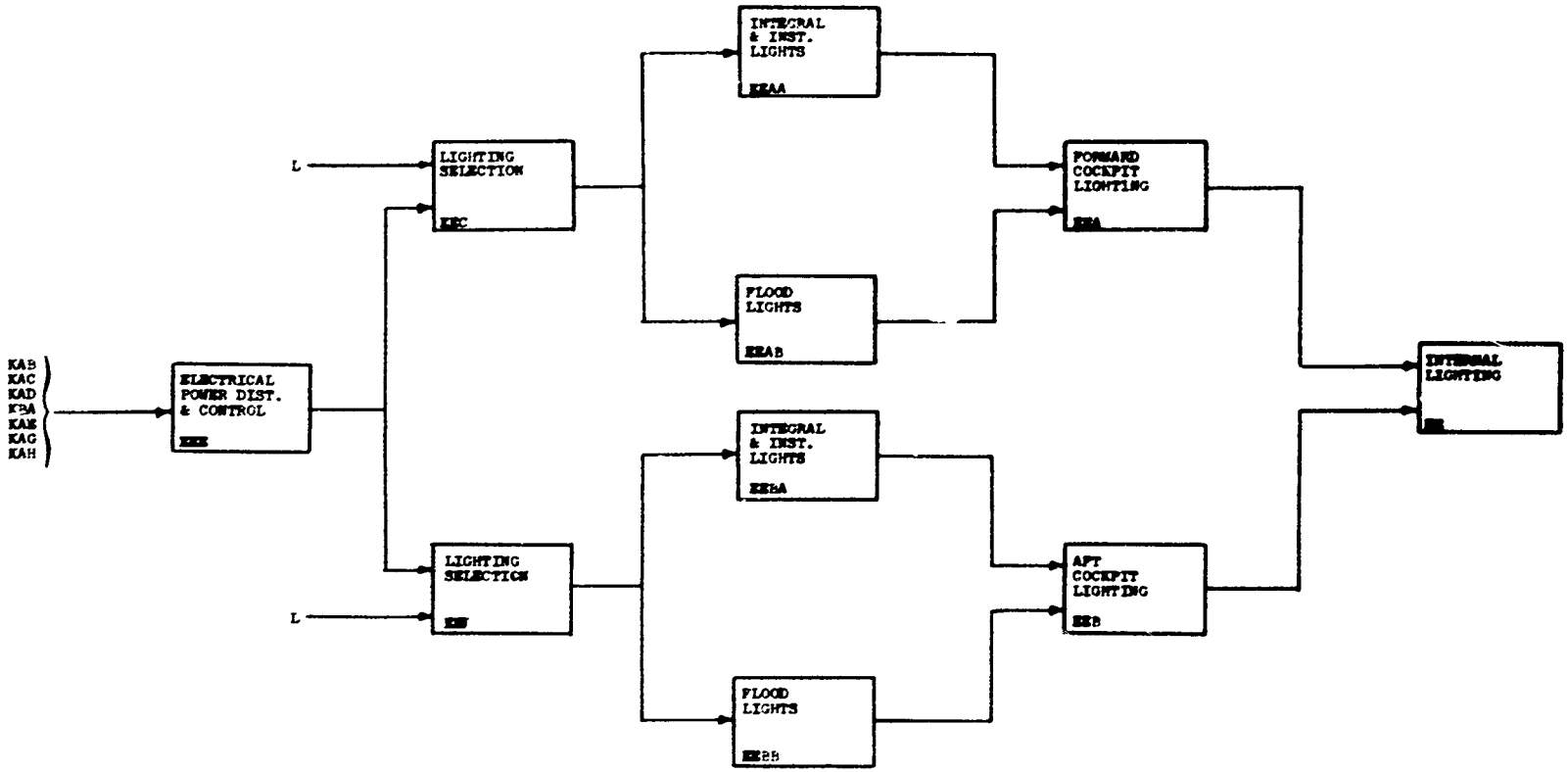
Aircraft: F-4J	
Title: Functional Diagram EQUIPMENT AUXILIARY AIR SYSTEM	
Document: NAVAIR 01-245FDB-2-2.5	rev. date 1 Jun 1968 10 Mar 1969
Date: 23 Apr 1969	

Section 5-1.2



Aircraft: F-4J	
Title: Functional Diagram EQUIPMENT AUXILIARY AIR SYSTEM	
Document: NAVAIR 01-245FDB-2-2.5	**rev. date** 1 Jun 1968
Date: 23 Apr 1969	

Section E-1.3



Aircraft: F-4J

Title: Functional Diagram
INTERNAL LIGHTING SYSTEM

Document: NAVAIR 01-245FDB-2-5 2 **rev. date** 15 Mar 1968

Date: 23 Apr 1969

Section E-1.4

	TITLE	WUC	ALPHA	INPUT	DEP FUNC	CD	AL	SENSITIVITY FC FN W 1 2 3 4 5 6 7 8
00	•INTERNAL ENVIRONMENT	D	E	EA				1 5 8 A A A A A 1
00		D	E	EB				
00		D	E	EC				
00		D	E	ED				
00		D	E	EE				
00		D	E	EF				
		D	E	EG				
01	•CABIN AIRCOND AND PRESS	D	EA	EAA	E			0 0 3 5 5 5 3 0 0
02		D	EA	EAB				
03		D	EA	EAC				
04		D	EA	EAD				
05		D	EA	EAE				
06		D	EA	EAF				
	•CABIN PRESSURIZATION	D	EAA	EAAA	EA			A A A A A A A A A
	•CABIN PRESSURE CONTROL	D	EAAA	EAAD	EAA			A A A A A A A A A
09		D	EAAA	EAAK				
10	PNEUMATIC DUMP VALVE	D41211	EAAAA				A	
11	FWD CKPT CABIN PRESS IND	D51118	EAAAB				2	
12	SCHLEN	D41210	EAAAC				A	
13	CABIN PRESSURE REGULATOR	D41216	EAAAD				A	
14	CHECK VALVE	D41210	EAAAE				A	
15	TRUE ATMOSPHERIC PRES HOSE	D41210	EAAAF				A	
16	CABIN PRESS SAFETY VALVE	D41215	EAAAG				A	
17	AFT CKPT CABIN PRESS IND	D51118	EAAAH				2	
18	BLD AR PRES REG + SHTOF VLV	D41128	EAAAJ				A	
19	STATIC PRESSURE LINE	D41210	EAAAK				A	
20	CABIN AIR INLET VALVE	D4111F	EAAAL				A	
	•BLEED AIR-COLD AIR MIXING	D	EAAD	EAAJ	EAAA	EAAK		A A A A A A A A A
		D	EAAD	EAAE	EAAB			A A A A A A A A A
24		D	EAAD	KAA				
24		D	EAAD	KBB				
24		D	EAAD	L				
25	TEMPERATURE CONTROL PANEL	D4111J	EAADA				A	
26	CABIN MANUAL TEMP LIMITER	D4111R	EAADB				A	
27	CABIN DUAL TEMP MIXING VALV	D41125	EAADC				A	
28	NO 2 CKT BREAKER PANEL	D42152	EAADE				A	
	•BLD AIR PRESS REG + DISTRIB	D	EAAJ	HAH	EAAD			A A A A A A A A A
		D	EAAJ	KBB	EAAG			A A A A A A A A A
		D	EAAJ		FCCB			A A A A A A A A A
31	BLD AR PRES REG + SHTOF VLV	D4112F	EAAJA				A	
32	REGULATED PRESS SENSNG LINE	D41128	EAAJB				A	
33	AIR DISTRIBUTION DUCT	D41117	EAAJC				A	
34	TOLERANCE COMPENSATOR	D4111W	EAAJD				A	
	•AFT CKPT HEAT DIFFUSING	D	EAB	EAAB	EA			1 1 1 1 1 1 1 1 1
36		D	EAB	EAAK				
37	FOOT HEAT AND DEFOG VALVE	D4111•	EABA				A	
38	FOOT HEAT-DEFOG CONTROL LVR	D41112	EABB				A	
39	AFT CKPT FOOT HEAT DIFFUSER	D41111	EABC				A	
40	CABIN AIR INLET VALVE	D4111F	EAAAL				A	
	•FWD CKPT HEAT DIFFUSING	D	EAC	EAAB	EA			1 1 1 1 1 1 1 1 1
42		D	EAC	EAAK				
43	FOOT HEAT AND DEFOG VALVE	D4111•	EACA				A	
44	FOOT HEAT-DEFOG CONTROL LVR	D41112	EACB				A	
45	FWD CKPT FOOT HEAT DIFFUSER	D41111	EACC				A	
46	CABIN AIR INLET VALVE	D4111F	EAAAL				A	
	•WINDSHIELD + CANOPY DEFOG	D	EAD	EAAB	FCA			5 5 5 5 5 5 5 5 5
48		D	EAD	EAAK				
49	WINDSHIELD CNT PNL DEFG NOZ	D41118	EADA				A	
50	WINDSHEILD SDE PNL DFG DUCT	D4111•	EADB				A	
51	FOOT HEAT-DEFOG VALVE	D4111•	EABA				A	
52	FOOT HEAT-DEFOG CONTROL LVR	D41112	EABB				A	
53	WNDSHLD + CANOPY DEFOG DUCT	D4111•	EADC				A	
54	WINDSHEILD DEFOG MANIFOLD	D4111N	EADD				A	
55	CABIN AIR INLET VALVE	D4111F	EAAAL				A	
56	•AFT PRES SUT PRES/TEMP COND	D	EAE	EAAC	EA			0 0 3 5 5 5 3 0 0
57	AFT PRESSURE SUIT	D96112	EAEA				A	
58	R10 COMPOSITE DISCONNECT	D41116	EAEB				A	
59	AFT PRESS SUT ANFL SHTOF VLV	D4111L	EAEC				A	
	•PRESS SUIT PRESS/TEMP REG	D	EAAC	EAAE	EAE			A A A A A A A A A
		D	EAAC	EAAG	EAF			A A A A A A A A A
63		D	EAAC	KAA				
64		D	EAAC	KBB				
65		D	EAAC	L				
66	PRESS MANUAL TEMP LIMITER	D4111H	EAACA				A	
67	PRESS SUIT TEMP LIMITER	D4111C	EAACB				A	
68	PRESS SUIT TEMP SENSOR	D4111D	EAACC				A	
69	PRESS SUIT PRESS REGULATOR	D41126	EAACD				A	
70	PRESS SUIT TEMP MIXING VALV	D41124	EAACE				A	
71	CHECK VALVE	D41120	EAACF				A	
72	PRESS SUIT MANUAL RELAY	D41120	EAACG				A	
73	FWD CKPT SUIT VENT AIR SELT	D4112•	EAACH				A	

74 AFT CKPT SUIT VENT AIR SELTD	4112*	EAACJ				A	
75*FWD PRES SUT TEMP/PRES CONDD		EAF	EAAC	EA			003555300
76 FWD PRESSURE SUIT	D96112	EAFA				A	
77 PILOT COMPOSITE DISCONNECT	D4111U	EAFB				A	
78 FWD PRES SUT ANFL SHTOF VLV	D4111L	EAFC				A	
*CABIN TEMPERATURE CONTROL	D	EAAB	EAAD	EAB	EAAK		AAAAAAAAA
	D	EAAB	KAA	EAC	EAAK		AAAAAAAAA
	D	EAAB	KBB	EAD	EAAK		AAAAAAAAA
82	D	EAAB	L				
83 TEMPERATURE CONTROL PANEL	D4111J	EAABA				A	
84 AUTO-MANUAL CONTROL SWITCH	D4111M	EAABB				A	
85 TEMPERATURE CONTROL KNOB	D4111*	EAABC				A	
86 MAGNETIC AMPLIFIER	D41113	EAABD				A	
87 CABIN TEMPERATURE SENSOR	D41115	EAABE				A	
88 CABIN MANUAL TEMP SENSOR	D4111R	EAABF				A	
89 TEMP CONTROL RHEOSTAT	D41118	EAABG				A	
90 NO 2 CKT BREAKER PANEL	D42152	EAADE				A	
*EMERG CABIN AIR COND + PRESD		EAAK	L	EAAA	K EAAD		006AAA600
	D	EAAK	KBB	EAB	K AAB		006AAA600
	D	EAAK	EAAH	EAC	K EAAB		006AAA600
	D	EAAK		EAD	K EAAB		006AAA600
93 EMERGENCY VENT CONTROL	D41213	EAAKA				A	
94 DUCTING	D41117	EAAKB				A	
95*PRESSURE SUIT HEAT EXCHANGED		EAAE	EAAG	EAAD			003555300
	D	EAAE	EAAF	EAAC			003553300
97 PRESS SUIT HEAT EXCHANGER	D4112C	EAAEA				A	
*AIR EXPANSION AND COOLING	D	EAAF	EAAH	EAAE			003555300
	D	EAAF	EAAG				
99	D	EAAF	KBB				
A0 TURBINE OVERSPEED SWITCH	D41123	EAAFA				A	
A1 CABIN MIXING VALVE	D41125	EAAFB				A	
A2 CABIN TURBINE OVERSPEED I	D4112*	EAAFC				1	
A3 COOLING TURBINE	D4112B	EAAFD				A	
*MAIN HEAT EXCHANGE	D	EAAG	EAAJ	EAAE			AAAAAAAAA
	D	EAAG	EAAH	EAAF			FAAAAAAAAA
	D	EAAG		FCA			AAAAAAAAA
A6 CABIN AIR OUTLET DUCT	D41128	EAAGA				A	
A7 RAM AIR SCOOP	D4111P	EAAGB				A	
A8 CABIN HEAT EXCHANGER	D4112D	EAAGC				A	
A9 HEAT EXCHANGER DRAIN VALVE	D4112*	EAAGD				A	
B0 RAM AIR OUTLET DUCT	D4111K	EAAGE				A	
B1 GROUND COOLING SHUTOFF VLV	D41127	EAAGF				A	
B2 RUPTURE DISC	D4112E	EAAGG				A	
B3 RAM AIR SCOOP	D4111P	EAAGH				A	
B4 RAM AIR DIFFUSER	D4111Q	EAAGJ				A	
B5 LANDING GEAR HANDLE SWITCH	D13112	CAAB				A	
B6 LANDING GEAR AUX RELAY	D1311*	DADC				A	
*RAM AIR SUPPLY	D	EAAH		EAAG			FAAAAAAAAA
	D	EAAH		EAAK			AAAAAAAAA
	D	EAAH		EAAF			AAAAAAAAA
*EQUIPMENT AIRCONDITIONING	E	EB	EBP	E			555555555
01	E	EB	EBQ				
01	E	EB	EBR				
01	E	EB	EBS				
	E	EB	EBT				
AIR PRESSURE REGULATION	E	EBAC	EBAD	EBPD			AAAAAAAAA
	E	EBAC	KBB	EBPC			AAAAAAAAA
65	E	EBAC	L				
66 OVERPRESSURE RELIEF VLV	E41134	EBACA				A	
67 RAM AIR CHECK VALVE	E41144	EBACB				A	
68 RAM AIR SHUTOFF VALVE	E41145	EBACC				A	
69 REGULATOR SENSING LINE	E4114*	EBACD				A	
70 PRESS REG + SHTOF VLV SOL	E41133	EBACE				A	
*BLEED AIR-RAM AIR HEAT EXCHE		EBAD	EBAF	EBAC			AAAAAAAAA
	E	EBAD	BAM	EC0			AAAAAAAAA
72 HEAT EXCHANGER	E4114E	EBADA				A	
73 HEAT EXCHANGER MOUNT BRACKTE	4114*	EBADB				A	
74 BLEED AIR INLET DUCT	E41134	EBADC				A	
75 BLEED AIR OUTLET DUCT	E41134	EBADD				A	
*UNREG POWER SUPPLY COOLING	E	EBP	EBPC	EBT			AAAAAAAAA
	E	EBP	EBAE	EB			AAAAAAAAA
*BLD AIR-COLD AIR MIX + DISTE		EBPC	EBPD	EBPB	EBAE		FAAAAAAAAA
		EBPC		EB	EBAE		$555555555
	E	EBPC	EBAC	EBP	EBAE		F555555555
	E	EBPC		EBQ	EBAE		F555555555
	E	EBPC		EBR	EBAE		F555555555
	E	EBPC		EBS	EBAE		F555555555
	E	EBPC		EBT	EBAE		F555555555
04 TEMPERATURE SENSOR	E41142	EBPCA				A	
05 TEMPERATURE LIMITER	E41143	EBPCB				A	
06 RESET LATCH	E4114*	EBPCC				A	

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07 TEMPERATURE CONTROL ASSY	E41132	EBPCD				A	
08 RESET SWITCH	E41134	EBPCE				A	
09 ALTITUDE PRESSURE SWITCH	E41137	EBPCF				A	
10 FWD COCKPIT CAUTION LIGHT	E41136	EBPCG				2	
11 AFT COCKPIT CAUTION LIGHT	E41136	EBPCH				2	
12 DUCTING	E41134	EBPCJ				A	
13 PRESS REG AND SHTOFF VLV	E4119A	EBPCK				A	
*AIR EXPANSION AND COOLING	E	ECPU	EBAC	EBPC			AAAAAAAAA
	E	ECPD	KAA	EBPB			AAAAAAAAA
14	E	EBPD	KBB				
14	E	EBPD	L				
14	E	EBPD	KAE				
15 TURBINE ASSEMBLY	E41140	EBPDA				A	
16 TURBINE MOUNTING BRACKETS	E41144	EBPDB				A	
17 TURBINE BYPASS VALVE	E41148	EBPDC				A	
18 TURBINE INLET DUCT	E41141	EBPDD				A	
19 GRND COOL EJECTOR SHTOF VLV	E41147	EBPDE				A	
20 TEMPERATURE CONTROL ASSY	E41132	EBPCD				A	
21 LANDING GEAR HANDLE SWITCH	E13112	DADH				A	
22 LANDING GEAR AUX RELAY	E13114	DADC				A	
23 RMLG SCISSORS SWITCH	E13145	DAAAAB				A	
24 NOSE GEAR LIMIT SWITCH	E13144	DAABAB				A	
*UPPER EQUIP SHELF COOLING	E	EBQ	EBPC	QAA			012333210
		EBQ		EB			AAAAAAAAA
	E	EBQ	EBAE	QAC			012333210
*VECTOR ANALYZER COOLING	E	EBR	EBPC	QAA			012333210
		EBR		EB			AAAAAAAAA
	E	EBR	EBAE	QAC			012333210
*EQUIP COOLING SHELF COOLING	E	EBS	EBPC	QAA			012333210
		EBS		EB			AAAAAAAAA
	E	EBS	EBAE	QAC			012333210
*RADM PKG PRESS AND COOLING	E	EBT	EBP	QAA			012333210
	E	EBT	EBPA	QAC			012333210
	E	EBT	EBPC	EB			AAAAAAAAA
30*LIQ COOLNT FLO CONTL + DISTE		EBPA	EBPB	EBT			AAAAAAAAA
31 RADAR COOLANT PUMP	E41711	EBPAA				A	
32 AUXILIARY RESERVOIR	E41713	EBPAB				A	
33 OVBD EXPAN RELIEF VALVE	E4171*	EBPAC				A	
34 BLEED VALVE	E4120*	EBPAD				A	
35 PRESSURE GAGE	E4120*	EBPAE				1	
36 ACCUMULATOR	E4120*	EBPAF				A	
37 LIQUID COOLANT DIST DUCTS	E4120*	EBPAG				A	
38 PRESS RELIEF VALVE	E4120*	EBPAH				A	
39 SOLENOID VALVE	E4120*	EBPAJ				A	
40 FILTER	E4120*	EBPAK				A	
41 RESERVIOR	E4120*	EBPAL				A	
42 TEMPERATURE GAGE	E4120*	EBPAM				A	
44 PRESSURE REGULATOR	E41221	EBPAN				1	
45 NO 1 MISC RELAY PANEL	E42111	EBPAP				A	
46 RADAR COOLANT PUMP CHECK SW	E4171*	EBPAQ				A	
47 HEAT EXCHANGER RELAY	E4171*	EBPAR				A	
48 TEMPERATURE CONTROL ASSY	E41135	EBPCD				A	
*LIQ COOLANT/AIR HEAT EXCH	E	EBPB	EBPD	EBPA			AAAAAAAAA
	E	EBPB	EBPC				
52 COOLANT/AIR HEAT EXCHANGER	E41712	EBPBA				A	
53 AUX COOLANT/AIR HEAT EXCHGR	E4171*	EBPBB				A	
54 TEMPERATURE CONTROL ASSY	E41135	EBPCD				A	
55 BLEED VALVE	E4171*	EBPCE				A	
56 TEMPERATURE GAGE	E4171*	EBPCF				1	
57 HEAT EXCHANGER RELAY	E4171*	EBPCG				A	
58 SOLENOID	E4171*	EBPCH				A	
*EQUIP EMERGENCY COOLING	E	EBAE	EBAF	EBP	K	EBPC	FAAAAAAAAA
	E	EBAE		EBQ	K	EBPC	FAAAAAAAAA
	E	EBAE		EBR	K	EBPC	FAAAAAAAAA
	E	EBAE		EBS	K	EBPC	FAAAAAAAAA
	E	EBAE		EBT	K	EBPC	FAAAAAAAAA
		EBAE		EB	K	BPC	SAAAAAAAAA
61 RAM AIR SHUTOFF VALVE	E41145	EBAEA				A	
62 DUCTING	E41144	EBAER				A	
00*EQUIPMENT AUXILIARY AIR	F	EC	ECP	E			222222222
00	F	EC	ECG				
00	F	EC	ECH				
00	F	EC	ECJ				
00	F	EC	ECL				
00	F	EC	ECN				
	F	EC	ECK				
02 CHEMICAL DRIER	F4115A	ECAA				A	
03 CHECK VALVE	F4115*	ECAB				A	
04 ABSOLUTE PRESS RELIEF VALVE	F41153	ECAC				A	
05 ABSOLUTE PRESS REGULATOR	F41152	ECAD				A	
06 TWO-WAY RESTRICTOR	F4115*	ECAE				A	

07 FILTER	F4115*	ECAF				A	
*RADIO RCVR-TRANSMITTER AIR	F	ECG	ECG	[illegible]			AAAAAAAAA
*RADIO RCVR-TRANSMITTER AIR	F	ECH	ECG	[illegible]			AAAAAAAAA
*AIR DATA COMPUTER AIR	F	ECJ	ECG	EC			AAAAAAAAA
	F	ECJ		CF			AAAAAAAAA
16 FILTER	F4115*	ECJA				A	
17 WATER TRAP	F4115*	ECJB				A	
18 TEST FITTING	F4115*	ECJC				A	
*ANTI-G SYSTEM AIR	F	ECK	ECG	EC	F		AAAAAAAAA
	F	ECK		EFA			FAAAAAAAAA
	F	ECK		EFB			FAAAAAAAAA
		ECK		EF			SAAAAAAAAA
*RADAR COMPARTMENT AIR	F	ECL	ECG	EC			AAAAAAAAA
21 DEHYDRATOR DESICCANT	F4115*	ECLB				A	
*AFT CKPT AX-EL RAN IND AIR	F	ECN	ECG	EC			AAAAAAAAA
28 CHEMICIAL DRIER	F4115A	ECAA				A	
29 CHECK VALVE	F4115*	ECAB				A	
30 ABSOLUTE PRESS RELIEF VALVE	F41153	ECAD				A	
31 ABSOLUTE PRESSURE REGULATOR	F41152	ECAE				A	
32 TWO-WAY RESTRICTOR	F4115*	ECAF				A	
33 FILTER	F4115*	ECAG				A	
CANOPY SEAL INFLATION	F	ECP	ECG	EC			AAAAAAAAA
	F	ECP		EGA			FAAAAAAAAA
	F	ECP		EGB			FAAAAAAAAA
		ECP		EG			SAAAAAAAAA
36 FILTER	F4115*	ECPA				A	
37 CHECK VALVE	F4115*	ECPB				A	
AUX AIR DISTRIBUTION	F	ECG	EBAD	ECP			FAAAAAAAAA
	F	ECG		ECG			FAAAAAAAAA
	F	ECG		ECH			FAAAAAAAAA
	F	ECG		ECJ			FAAAAAAAAA
	F	ECG		ECK			FAAAAAAAAA
	F	ECG		ECL			FAAAAAAAAA
	F	ECG		ECN			FAAAAAAAAA
		ECG		EC			SAAAAAAAAA
	F	ECG		BBD			AAAAAAAAA
	F	ECG		BBM			AAAAAAAAA
	F	ECG		BBJ			AAAAAAAAA
	F	ECG		KGE			AAAAAAAAA
39 DUCTING	F4115*	ECGA				A	
40 FITTINGS	F4115*	ECGB				A	
*OXYGEN SYSTEM	G	ED	EDA	E			00AAAAA00
02	G	ED	EDB				
04*NORMAL SYSTEM	G	EDA	EDAA	ED	EDF		003555300
05	G	EDA	EDAB				
06*FWD COCKPIT DISTRIBUTION	G	EDAA	EDC	EDA			003555300
07	G	EDAA	L				
08 LOX QUANTITY INDICATOR	G51851	EDAAA				A	
09 PRESS SUIT LOX VALVE	G47212	EDAAB				A	
10 LOW WARNING LIGHT	G47213	EDAAC				A	
11 DILUTER DEMAND REGULATOR	G47214	EDAAD				A	
12 LOX FLEXIBLE HOSE	G47215	EDAAE				A	
13 LOWER DISCONNECT BLOCK	G47216	EDAAF				A	
14 LOWER DISCONNECT	G47217	EDAAG				A	
15 LOX VALVE	G4721A	EDAAH				A	
16 COMPOSITE DISCONNECT	G4721C	EDAAJ				A	
17 LOX REPEATER AMPLIFIER	G4721E	EDAAK				A	
18 PRIMARY AMPLIFIER	G4721F	EDAAL				A	
19 LOX GAGE	G51852	EDAAM				1	
20 LOX PRESSURE GAGE	G51853	EDAAN				A	
21 PRESSURE REDUCER	G4721L	EDAAP				A	
22 LOX REGULATOR	G4721N	EDAAQ				A	
23 REGULATOR PANEL	G4721Q	EDAAR				A	
24 INTERMEDIATE BLOCK	G4721R	EDAAS				A	
25 UPPER BLOCK	G4721S	EDAAT				A	
26 MASTER QUANTITY AMPLIFIER	G51854	EDAAU				A	
27 SUPPLY PRESS INDICATOR	G51855	EDAAV				A	
28*AFT COCKPIT DISTRIBUTION	G	EDAB	EDC	EDA			003555300
	G	EDAB	L				
29 LOX QUANTITY INDICATOR	G51851	EDABA				A	
36 LOX VALVE	G4721A	EDABH				A	
37 COMPOSITE DISCONNECT	G4721C	EDABJ				A	
38 LOX REPEATER AMPLIFIER	G4721E	EDABK				A	
39 PRIMARY AMPLIFIER	G4721F	EDABL				A	
40 LOX GAGE	G51852	EDABM				1	
LOX PRESSURE GAGE	G51853	EDABN				A	
42 PRESSURE REDUCER	G4721L	EDABP				A	
43 LOX REGULATOR	G4721N	EDABQ				A	
44 REGULATOR PANEL	G4721Q	EDABR				A	
45 INTERMEDIATE BLOCK	G4721R	EDABS				A	
46 UPPER BLOCK	G4721S	EDABT				A	

47 MASTER QUANTITY AMPLIFIER	G51854	EDABU				A	
48 SUPPLY PRESSURE INDICATOR	G51855	EDABV				A	
*OXYGEN SUPPLY (LOX)	G	EDC	L	EDAA		FAAAAAAAAA	
	G	EDC		EDAB		FAAAAAAAAA	
		EDC		EDA		SAAAAAAAAA	
51 LOX CONVERTER	G47111	EDCA				A	
52 LOX CONTAINER	G47112	EDCB				A	
53 FILL-R/U VENT VALVE	G47113	EDCC				A	
54 RELIEF VALVE	G47114	EDCD				A	
55 CHECK VALVE	G4711K	EDCE				A	
56 PRESS OPEN/CLOSE VALVE	G47116	EDCF				A	
57 CAPACITANCE PROBE	G47117	EDCG				A	
58 WARM-UP PLATE	G4711B	EDCH				A	
59 LOX FILLER VALVE	G4711F	EDCJ				A	
60 PREAMPLIFIER	G4711H	EDCK				A	
61 MOUNT	G4711J	EDCL				A	
*EMERGENCY SYSTEM	G	EDB	EDBA	ED	K EDA	00AAAAA00	
63	G	EDB	EDBB				
64*FOWARD COCKPIT	G	EDBA	L	EDB		00AAAAA00	
65 EMERG OXYGEN CYLINDER	G47221	EDBAA				A	
66 PRESSURE GAGE	G47222	EDBAB				A	
67 EMERGENCY OXYGEN REGULATOR	G47223	EDBAC				A	
EMERGENCY CONTROLLER	G47224	EDBAD				A	
69 ANTI-SUFFOCATION VALVE	G47225	EDBAE				A	
70 CONTROL VALVE	G47226	EDBAF				A	
71 RESET LEVER	G47227	EDBAG				A	
72*AFT COCKPIT	G	EDBB	L	EDB		00AAAAA00	
73 EMERGENCY OXYGEN CYLINDER	G47221	EDBBA				A	
74 PRESSURE GAGE	G47222	EDBBB				A	
75 EMERGENCY OXYGEN REGULATOR	G47223	EDBBC				A	
30 PRESS SUIT LOX VALVE	G47212	EDABB				A	
31 LOW WARNING LIGHT	G47213	EDABC				A	
32 DILUTER DEMAND REGULATOR	G47214	EDABD				A	
33 LOX FLEXIBLE HOSE	G47215	EDABE				A	
34 LOWER DISCONNECT BLOCK	G47216	EDABF				A	
35 LOWER DISCONNECT	G47217	EDABG				A	
76 EMERGENCY CONTROLLER	G47224	EDBBD				A	
77 ANTI-SUFFOCATION VALVE	G47225	EDBBE				A	
78 CONTROL VALVE	G4722R	EDBBF				A	
79 RESET LEVER	G47227	EDBBG				A	
*INTERNAL LIGHTING	H	EE	EEA	E	D	022222220	
02	H	EE	EEB				
03*FWD COCKPIT LIGHTING	H	EEA	EEAA	EE		AAAAAAAAA	
04	H	EEA	EEAB				
*INTEGRAL + INST LIGHTS	H	EEAA	EEC	EEA		555555555	
06 VERTICAL CAUTION PANEL	H44111	EEAAA				A	
07 COCKPIT CONTROL PANEL	H44112	EEAAB				A	
08 MASTER CAUTION LIGHT	H44117	EEAAC				A	
09 CAUTION TEST CONTROL UNIT	H4411A	EEAAD				A	
10 WHEELS WARNING	H4411B	EEAAE				A	
11 CAUTION LITE RELAY PANEL	H4411C	EEAAF				A	
12 INDEXER LITE CONTROL PANEL	H4411D	EEAAG				A	
13 STANDBY COMPASS LIGHT	H4411F	EEAAH				A	
14 INSTRU PANEL EDGE LIGHT	H4411G	EEAAJ				A	
15 RELAY PANEL TEST LIGHTS	H4411H	EEAAK				A	
16 MISSILE STATUS PANEL	H4411J	EEAAL				A	
17 PILOT EJECTION LIGHT/SWITCH	H4411L	EEAAM				A	
18 WARNING LIGHT RELAY PANEL	H4411P	EEAAN				A	
19 MASTER CAUTION RESET SWITCH	H4411E	EEAAP				A	
*FLOOD LIGHTS	H	EEAB	EEC	EEA		555555555	
21 EMERGENCY FLOOD PANEL	H44113	EEABA				A	
22 RED CONTROL FLOOD LIGHT	H44114	EEABB				A	
23 RED INST FLOODLIGHT	H44115	EEABC				A	
24 UTILITY SPOT LIGHT	H44116	EEABD				A	
25 READ-FLOOD LIGHT ASSY	H44118	EEABE				A	
26 COCKPIT FLOODLIGHTS	H4411M	EEABF				A	
27 COCKPIT EMERG FLOODLIGHTS	H4411N	EEABG				A	
28*AFT COCKPIT LIGHTING	H	EEB	EEBA	EE		AAAAAAAAA	
29	H	EEB	EEBB				
*INTEGRAL + INST LIGHTS	H	EEBA	EED	EEB		555555555	
31 COCKPIT INST LIGHT PANEL	H44121	EEBAA				A	
32 RADAR SCREEN WARN LIGHT	H44126	EEBAB				A	
33 EJECT WARNING LIGHT	H44127	EEBAC				A	
34 WARNING LIGHT ASSY	H44128	EEBAD				A	
35 TELELIGHT AFT PANEL	H4412A	EEBAE				A	
36 VERT CAUTION PANEL	H44111	EEBAF				A	
37 INST PANEL EDGE LIGHT	H4411G	EEBAG				A	
*FLOOD LIGHTS	H	EEBB	EED	EEB		111111111	
39 RED CONTROL FLOODLIGHT	H44114	EEBBA				A	
40 RED INST FLOODLIGHT	H44115	EEBBB				A	
41 UTILITY SPOT LIGHT	H44116	EEBBC				A	

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42 HEAD-FLOOD LIGHT          H04118   EEDBD                    A
43 EMERGENCY FLOODLIGHT      H0411N   EEDBE                    A
44*LIGHTING SELECTION        H        EEC      EEE    EEAA      FAAAAAAAAA
45                           H        EEC      L      EEAR      FAAAAAAAAA
                                      EEC             EEA       SAAAAAAAAA
46 COCKPIT LIGHTS CONTROL PNL H04112  EECA                     A
47 LIGHTING SELECTION        H        EED      EEE    EEBA      FAAAAAAAAA
                             H        EED      L      EEBB      FAAAAAAAAA
                                      EED             EEB       SAAAAAAAAA
48 COCKPIT LIGHTS CONTROL PNELH04112  EEDB                     A
49*ELECTRICAL PWR DIST + CONTLH       EEE      KAB    EEC       FAAAAAAAAA
                             H        EEE      KAC    EED       FAAAAAAAAA
51                           H        EEE      KAD    EE        SAAAAAAAAA
52                           H        EEE      KBA
53                           H        EEE      KAE
54                           H        EEE      KAG
55                           H        EEE      KAH
56                           H        EEE      L
   NO 2 CKBR PANEL           H02152   EEEA                     A
58 INTEGRAL LITES AUTOTRANSFONH0411*  EEER                     A
59 WIRING                    H0411*   EEEE                     A
  *ANTI-G SYSTEM             I        EF       EFA    E         001111100
01                           I        EF       L
                             I        EF       EFB
  *FWD ANTI-G SYSTEM         I        EFA      ECK    EF        005555500
                             I        EFA      L
   FWD ANTI-G SUIT           I06111   EFAA                     A
   FWD ANTI-G VALVE          I01411   EFAB                     A
   FWD COMPOSITE DISCONNECT  I01111U  EAFB                     A
   FWD G-SUIT RELIEF VALVE   I01401*  EFAD                     A
   FWD G-SUIT EXHAUST PORT   I01401*  EFAE                     A
   FWD MANUAL INFLATION BOTTONI01401* EFAF                     A
  *AFT ANTI-G SYSTEM         I        EFB      ECK    EF        005555500
                             I        EFB      L
   AFT ANTI-G SUIT           I06111   EFBA                     A
   AFT ANTI-G VALVE          I01411   EFBB                     A
   AFT COMPOSITE DISCONNECT  I01110   EAEB                     A
   AFT G-SUIT RELIEF VALVE   I01401*  EFBD                     A
   ANT G-SUIT EXHAUST PORT   I01401*  EFBE                     A
   AFT MANUL INFLATION BUTTON I01401* EFBF                     A
   CANOPY SEAL               0        EG       EGA    E         001222100
02                           0        EG       EGB
03*FOWARD CANOPY SEAL        0        EGA      ECP    EG        00AAAAA00
                             0        EGA      L
                             0        EGA      JAHAD
06 FILTER                    04121*   EGAA                     A
07 CHECK VALVE               04121*   EGAB                     A
08 PRESSURE REGULATOR        04121*   EGAC                     A
09 CANOPY SEAL BELLOWS       04121*   EGAD                     A
10 FOWARD CANOPY SEAL        04121*   EGAE                     A
11*AFT CANOPY SEAL           0        EGB      ECP    EG        00AAAAA00
12                           0        EGB      JAHAA
13                           0        EGB      L
14 FILTER                    04121*   EGBA                     A
15 CHECK VALVE               04121*   EGBB                     A
16 PRESSURE REGULATOR        04121*   EGBC                     A
17 CANOPY SEAL BELLOWS       04121*   EGBD                     A
18 AFT CANOPY SEAL           04121*   EGBE                     A
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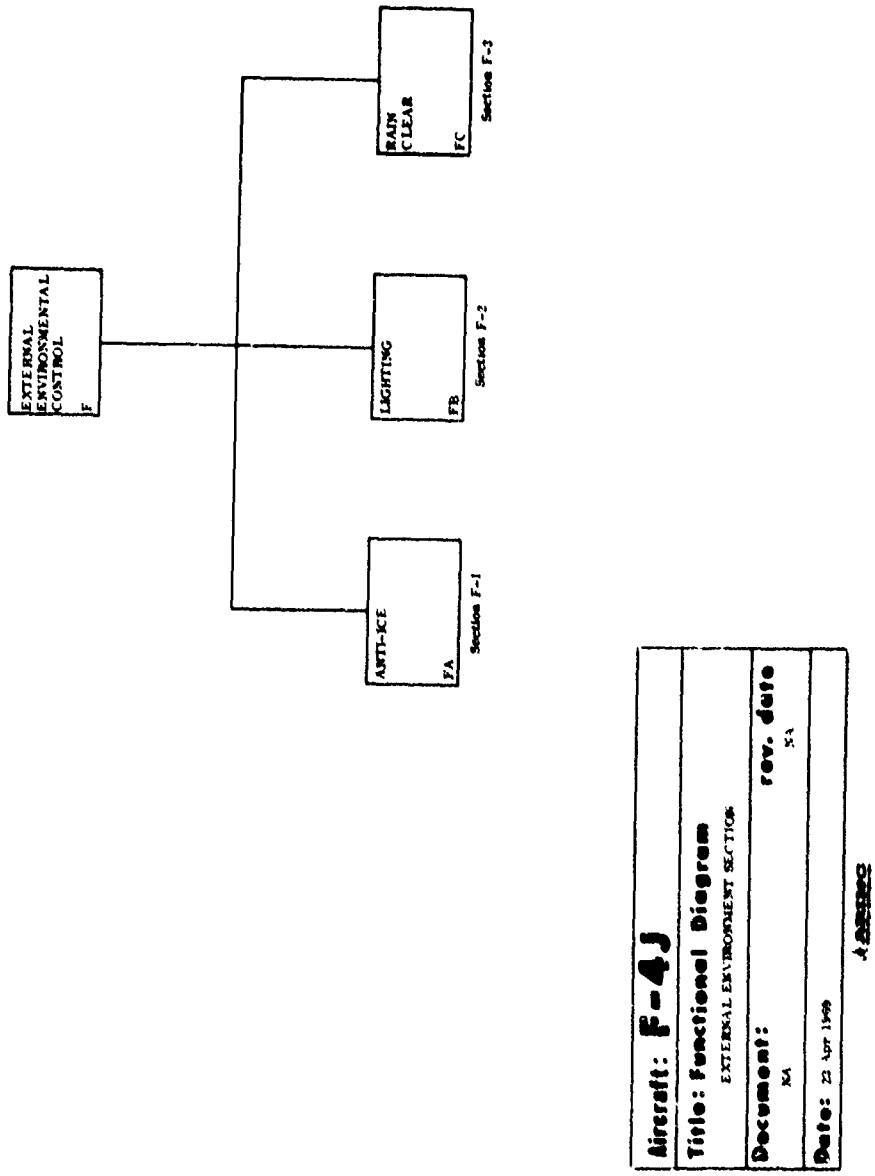
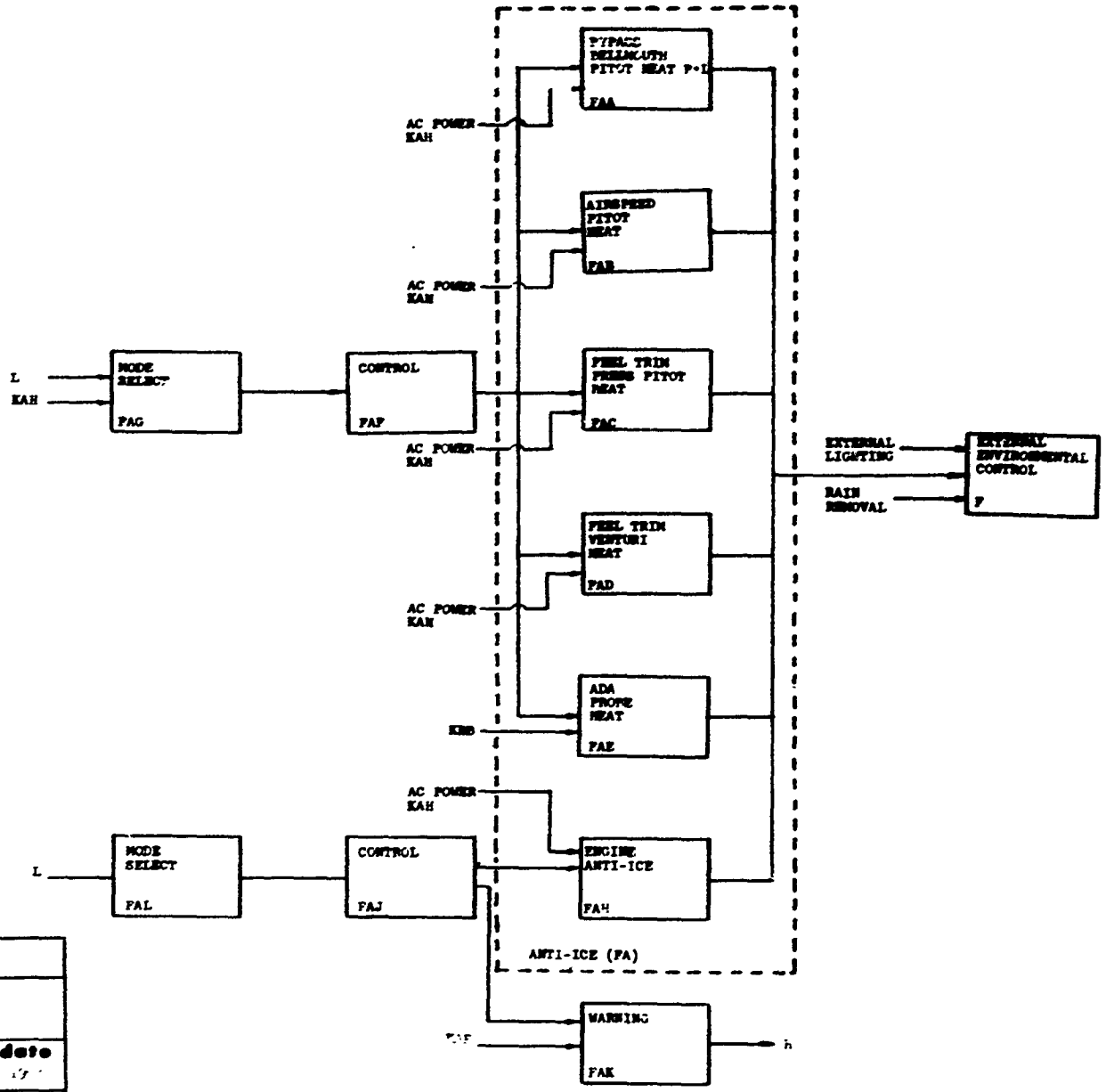
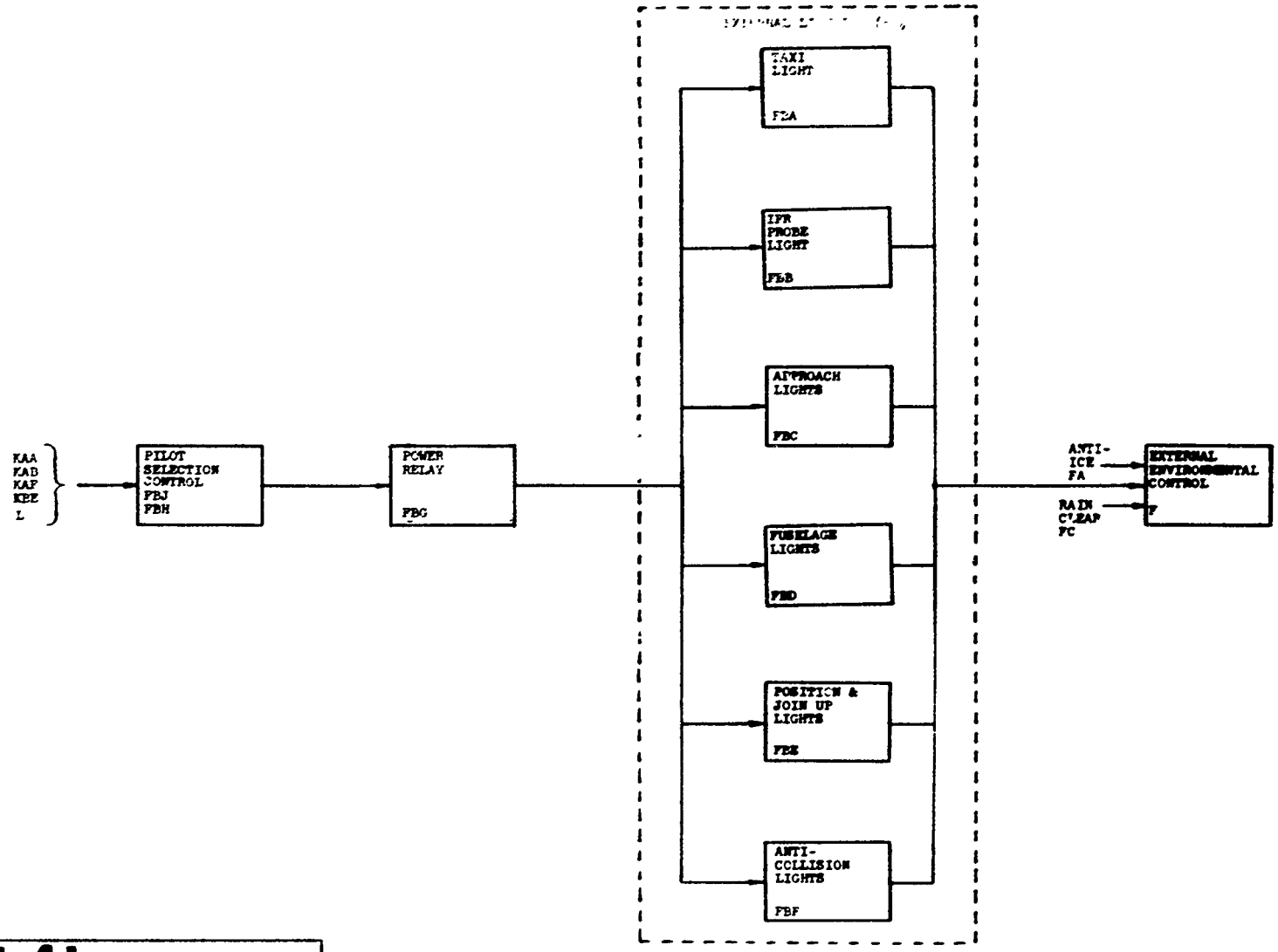
F. EXTERNAL ENVIRONMENT SECTION



Section F



Aircraft: F-4J	
Title: Functional Diagram EXTERNAL ENVIRONMENT (F) ANTI-ICE (FA)	
Document:	**rev. date**
Date:	



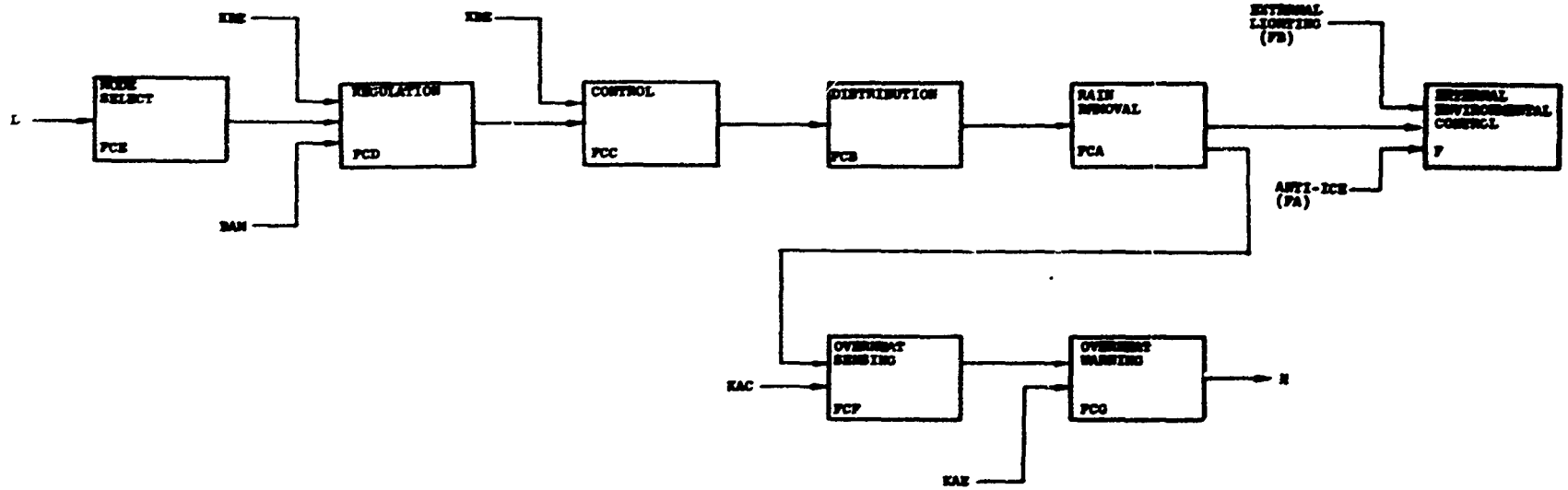
Aircraft: F-4J

Title: Functional Diagram
EXTERNAL ENVIRONMENTAL CONTROL (F)
EXTERNAL LIGHTING (FB)

Document: NAVAIR [illegible] **rev. date** [illegible]

Date: [illegible]

Section F-2

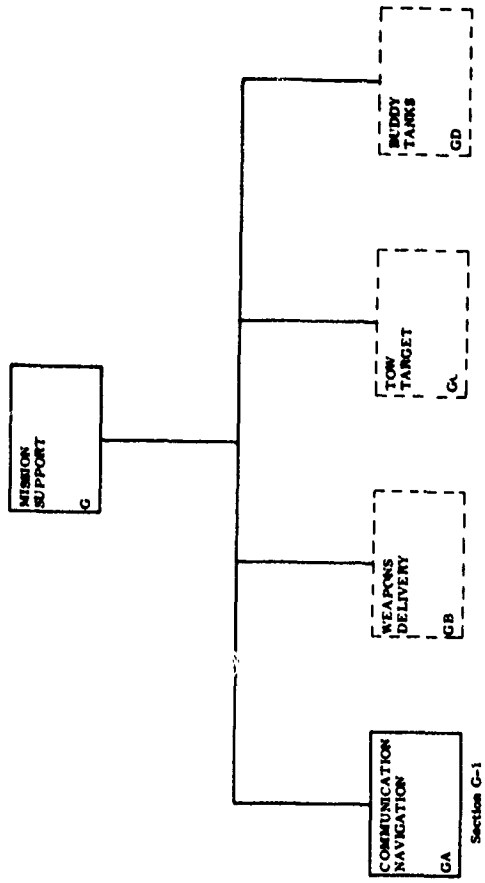


Aircraft: F-4J	
Title: Functional Diagram EXTERNAL ENVIRONMENTAL CONTROL (F) RAIN REMOVAL (FCA)	
Document: NAVAIR 01-245FDE-2-2.5	**rev. date** 1 June 1968
Date: 23 April 1969	

	TITLE	WUC	ALPHA	INPUT	DFP FUNC	CD FC	AL FN	SENSITIVITY W 123456789
	EXTERNAL ENVIRONMENT		F	FA				AAAAAAAAA
	•BYPASS BELLMOUTH PITOT HT	J	FAA	FAF	F	A		065444560
		J	FAA	KAH				
		J29A1H	FAAA				A	
	•AIRSPEED PITOT HEAT	J	FAB	FAF	F	A		076333370
		J	FAB	KAH				
		J51132	FABA				A	
	•FEEL TRIM PRESS PROBE HT	J	FAC	FAF	F	A		032111230
		J	FAC	KAH				
		J14337	FACA				A	
	•FEEL TRIM VENTURI HEAT	J	FAD	FAF	F	A		032111230
		J	FAD	KAH				
		J14338	FADA				A	
	•AOA PROBE HEAT	J	FAE	FAF	F	A		065111560
		J	FAE	KBB				
		J56865	FAEA				A	
	CONTROL-SENSORS ANTI-ICE	J	FAF	FA6	FAA			FAAAAAAAAA
		J	FAF		FAB			FAAAAAAAAA
		J	FAF		FAC			FAAAAAAAAA
		J	FAF		FAD			FAAAAAAAAA
		J	FAF		FAE			FAAAAAAAAA
			FAF		F	A		S777777777
13	15 AMP C/B-A/S AND FEEL SYS	J4111•	FAFA				A	
14	5AMP C/B-BELLMOUTH	J42152•	FAFB				A	
15	5AMP C/B-AOA PROBE HEATER	J42152•	FAFC				A	
16	RELAY-BELLMOUTH PITOT HTR	J42111•	FAFD				A	
	RMLG SCISSORS SWITCH	J13145	RDAAAQ				A	
	NOSE GEAR DWN LIMIT SWITCH	J13143	DAABAA				A	
19	AOA HEATER RELAY	J42111•	FAFG				A	
	MODE SELECT	J	FA6	KAH	FAF			AAAAAAAAA
21		J	FA6	L				
22	SWITCH-AIRSPED AND FEEL SYS	J51138	FA6A				A	
23	•ENGINE ANTI-ICE	J	FAH	FAJ	F	A		022111210
24		J	FAH	KAH				
	CONTROL-ENGINE ANTI-ICE	J	FAJ	FAL	FAH			AAAAAAAAA
		J	FAJ		FAK			AAAAAAAAA
27	5AMP C/B-ANTI-ICE	J42151•	FAJA				A	
28	ANTI-ICE VALVE	J23AB700R	FAJB				A	
29	ANTI-ICE VALVE	J23AB100L	FAJC				A	
		J	FAK	FAJ	H			555555555
31		J	FAK	KAE				
32	5AMP FUSE	J23AB1••	FAKA				A	
33	DIFF PRESS SWITCH	J23AB2	FAKB				A	
34	CAUTION LITE CONTROL ASSY	J23AB1••R	FAKC				A	
35	CAUTION LITE CONTROL ASSY	J23AB1••L	FAKD				A	
36	CAUTION LITE	J23AB1••R	FAKE				A	
37	CAUTION LITE	J23AB1••L	FAKF				A	
	MODE SELECT	J	FAL	L	FAJ			AAAAAAAAA
39	ANTI-ICE SWITCH	J23AB1••	FALA				A	
	•TAXI LIGHTING	K	FBA	FB6	F	D		100000001
	TAXI LIGHT	K44225	FBAA				A	
	•IFR PROBE LIGHTING	K	FBB	FB6	F	D		000505000
	IFR PROBE LIGHT	K44228	FBBA				A	
	•APPROACH LIGHTING	K	FBC	FB6	F	D		000000010
	APPROACH LIGHTS	K44227	FBCA				A	
	•FUSELAGE LIGHTING	K	FBD	FB6	F	D		111111111
	FUSELAGE LIGHTS	K44220	FBDA				A	
	UPPER LIGHT	K44221	FBDB				A	
	LOWER LIGHT	K44222	LFBDC				A	
	LOWER LIGHT	K44222	RFBDC				A	
	•POSITION JOIN-UP LIGHTS	K	FBE	FB6	F	D		112222211
	WING-TIP JOIN UP LIGHTS	K44231	LFBEA				A	
	WING-TIP POSITION LIGHTS	K44232	LFBEB				A	
	WING-TIP JOIN-UP LIGHTS	K44231	RFBEC				A	
	WING-TIP JOIN-UP LIGHTS	K44232	RFBED				A	
	TAIL LIGHT	K44223	FBEE				A	
	•ANTI-COLLISION LIGHTING	K	FBF	FB6	F	D		011111110
	ANTI-COLLISION LIGHTS	K44224	FBFA				A	
	POWER DISTRIBUTION	K	FB6	FBH	FBA			FAAAAAAAAA
		K	FBG		FBB			FAAAAAAAAA
		K	FBG		FBC			FAAAAAAAAA
		K	FBG		FBD			FAAAAAAAAA
		K	FBG		FBE			FAAAAAAAAA
		K	FBG		FBF			FAAAAAAAAA
			FB6		F			S111111111
	APPROACH LIGHT RELAY	K42112•	FBGA				A	
	WING TIP LIGHT RELAY	K42112•	FBGB				A	
	ANTI-COLLISION LIGHT RELAY	K42112•	FBGC				A	
	FLASHER RELAY-ANTI COLLISN	K42112•	FBGD				A	
	FLASHER RELAY-JOIN UP LIGHT	K42112•	FBGE				A	
	EXTERIOR LIGHTS FLASLER	K44213	FBGF				A	

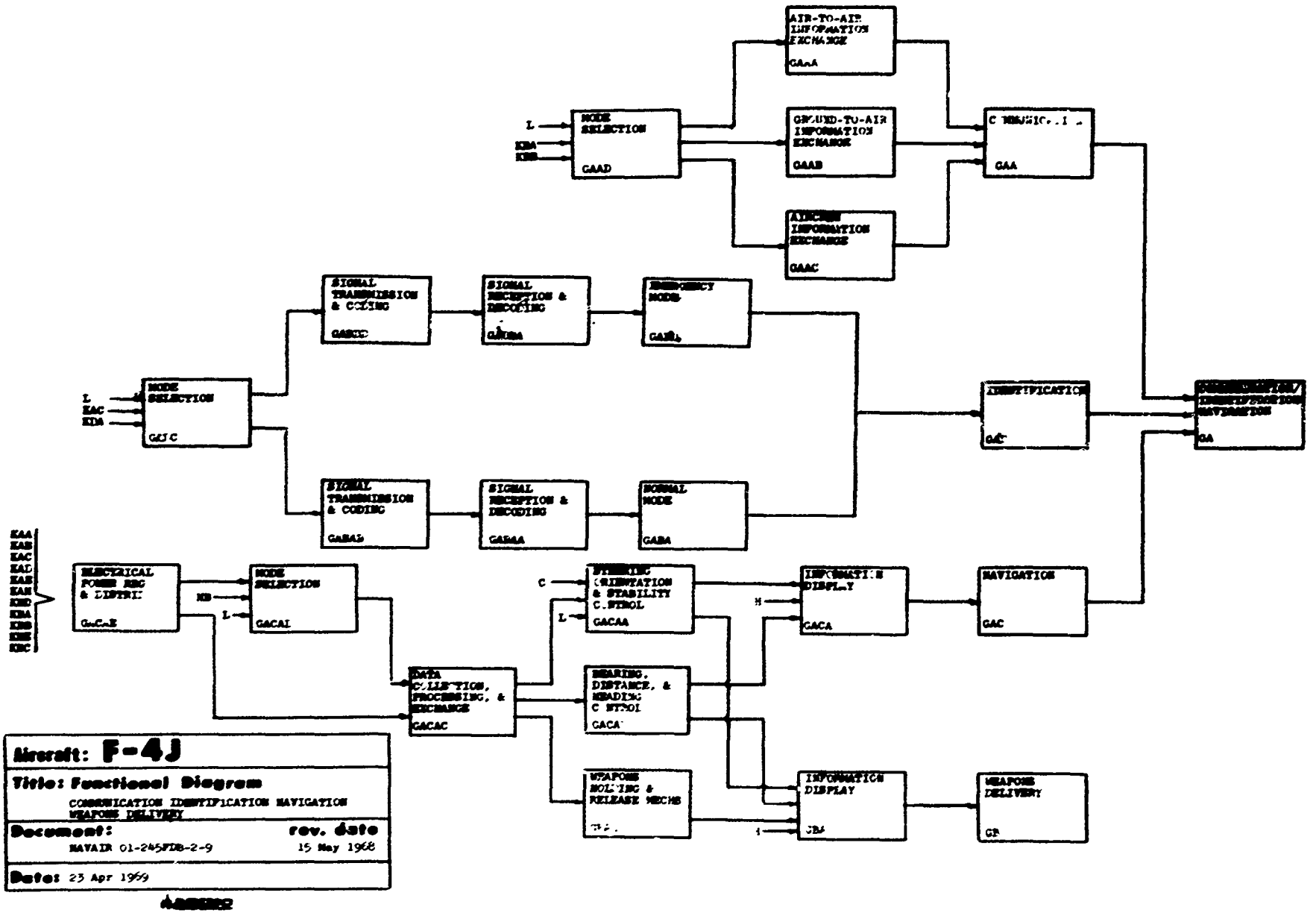
	APPROACH LIGHT DIM RELAY	K42112*	FBGE				A	
	PILOT SELECTION/CONTROL	K	FBH	L	FB0			AAAAAAAAA
26		K	FBH	KAA				
26		K	FBH	KAB				
26		K	FBH	KAF				
26		K	FBH	KBE				
27	TAXI LITE SWITCH	K44217	FBHA				A	
28	15 AMP TAXI LITE CKT BRKR	K4422*	FBHB				A	
29	IFR PROBE LITE SWITCH	K4422*	FBHC				A	
30	IFR PROBE LITE DIM/BRT CTRL	K4422*	FBHD				A	
31	5 AMP IFR PROBE CKT BRKR	K42152*	FBHE				A	
32	WING LITES SWITCH	K4423*	FBHF				A	
33	TAIL LITE SWITCH	K4422*	FBHG				A	
34	WING LITE DIM CKT BRKR	K42152*	FBHH				A	
35	WING LITE BRT CKT BRKR	K42152*	FBHJ				A	
36	EXTERIOR LITES MASTER SW	K44215	FBHK				A	
37	STEADY/FLASH SW-EXT LITES	K4421*	FBHL				A	
38	FUSELG LITES ON/OFF SWITCH	K4422*	FBHM				A	
39	FUSELG LITES-DIM/BRT SW	K4422*	FBHN				A	
40	FUSELG LITES FLASH SWITCH	K4422*	FBHP				A	
41	5 AMP MASTER SW CKT BRKR	K42152*	FBHQ				A	
42	ANTI-COLL LITES CKT BRKR	K4422*	FBHR				5	
	NOSE GEAR DWN LIMIT SW	K13143	DAABAA				A	
	R MAIN GEAR DWN LIMIT SW	K13142	RDAAAAC				A	
	L MAIN GEAR DWN LIMIT SW	K13142	LDAAAAC				A	
	LMAIN GEAR SCISSORS SW	K13145	LDABAD0				A	
	HOOK DWN LIMIT SWITCH	K1353*	AACEC				A	
48	HOOK BYPASS SWITCH	K1351*	FBJF				A	
	FLAP LIMIT SWITCH	K1455F	CDBDH				A	
	FLAP FLASHER RELAY	K42112*	FBJH				A	
	5 AMP CKT BRKR LITE	K42152*	FBJK				A	
	5 AMP CKT BRKR-A LITE RELAY	K42152*	FBJL				A	
	FLAP-UP FLASHER	K1455*	FBJM				A	
	5 AMP CKT BRKR-FLAP FLASHER	K42152*	FBJN				A	
	RAIN REMOVAL/CANOPY DEFOG	L	FCA	FCB	F	D6		111111151
		L	FCA	EAD	FCF			AAAAAAAAA
03	RAIN REMOVAL NOZZLE	L41313	FCAA				A	
	DISTRIBUTION	L	FCB	FCC	FCA			AAAAAAAAA
05	DRAIN VALVE	L4131*	FCBA				A	
06	PRIMARY HEAT EXCHANGER	L41120	EAA0C				A	
07	DUCT	L4131*	FCBC				A	
	CONTROL	L	FCC	FCD	FCB			AAAAAAAAA
09		L	FCC	KBE				
10	RAIN REMOVAL VALVE	L4131B	FCCA				A	
11	BYPASS VALVE	L41316	FCCB				A	
	REGULATION	L	FCD	FCE	FCC			AAAAAAAAA
13		L	FCD	BAM				
		L	FCD	KBE				
14	PRESS REGULATR/SHUT-OFF VLV	L41312	FCDA				A	
	MODE SELECT	L	FCE	L	FCD			AAAAAAAAA
16	RAIN REMOVAL SWITCH	L4131A	FCEA				A	
17	5AMP CIRCUIT BREAKER	L42152*	FCEB				A	
	OVERHEAT SENSING	L	FCF	FCA	FC0	6		AAAAAAAAA
		L	FCF	KAC				
20	5AMP CIRCUIT BREAKER	L42152*	FCFA				A	
	TEMP SENSING AMPLIFIER	L4131*	FCFB				A	
22	TEMP SENSOR	L41311	FCFC				A	
	OVERHEAT WARNING	L	FC0	FCF	H			011111110
24		L	FC0	KAE				
25	5AMP CIRCUIT BREAKER	L42152*	FC0A				A	
26	TEST RELAY	L42111*	FC0B				A	
57	PANEL CAUTION LITE	L4131*	FC0C				A	

G. MISSION SUPPORT SECTION



Aircraft: F-4J	
Title: Functional Diagram MISSION SUPPORT SECTION	
Document: NA	rev. date NA
Date: 23 Apr 1969	

Section G



Aircraft: F-4J

Title: Functional Diagram

COMMUNICATION IDENTIFICATION NAVIGATION WEAPONS DELIVERY

Document: NAVAIR 01-245FDB-2-9 **rev. date** 15 May 1968

Date: 23 Apr 1969

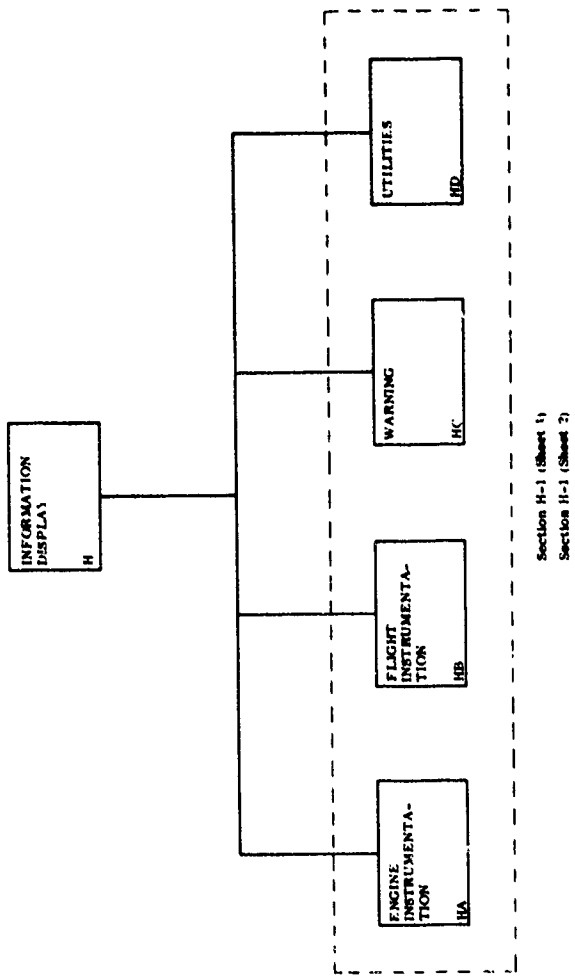
	TITLE	WUC	ALPHA	INPUT	DFP FUNC	CD FC	AL FN	W	SENSITIVITY 123456789
	*MISSION SUPPORT	M	G	GA					002555550
00		M	G	GB					
00		M	G	GC					
00		M	G	GD					
	COM/IDENTIF/NAVIGATION	M	GA	GAA	G	E			AAAAAAAAA
02		M	GA	GAB					
03		M	GA	GAC					
04	*COMMUNICATION	M	GAA	GAAA	GA				025555510
05		M	GAA	GAAB					
06		M	GAA	GAAC					
		M	GAA	EBQ					
		M	GAA	EBR					
		M	GAA	EBS					
		M	GAA	EBT					
09	RAD RCV-TRNS RT-793/ASQ	M6319***	GAAAB					A	
16	UHF COMM ANTENNAS	M6312N	GAAAJ					A	
20	FWD COCKPIT HEADSET	M64816	GAAAN					A	
21	AFT COCKPIT HEADSET	M64816	GAAAP					A	
07	*AIR TO AIR INFORMATION EXCHM		GAAA	GAAD	GAA				011111100
11	AMP REL ASSY AM-3624/ARA-50	M631****	GAAAD					A	
12	ADF ANTENNA AS-909/ARA-48	M631****	GAAAE					A	
13	UHF COMM FILTER	M6712D	GAAAF					A	
15	COMM COAX RELAY	M63181C0	GAAAH					A	
17	FREQ CHANL IND ID-1311OASQ	M631****	GAAAK					A	
18	ATTITUDE REF HDMR COMPUTER	M73110	GAAAL					A	
19	RDR RCVR-TRNSM OR-18A/ALQ91	M65*****	GAAAM					A	
22	FWD INTERCOMM AMPLIFIER	M6481N	GAAAQ					A	
23	AFT INTERCOMM AMPLIFIER	M6481N	GAAAR					A	
24	TAKE COMMAND RELAY PANEL	M6712H	GAAAS					A	
	*AIR-TO-GROUND INFRMTN EXCH	M	GAAB	GAAD	GAA				0233AAAAC
28	INTERCOMM STATION LS-459	M6712E	GAABA					A	
29	UHF-ICS SWITCH	M6481*	GAABB					A	
30	ICS FOOT SWITCH	M6481*	GAABC					A	
31	HEADSET-MICROPHONE ADAPTERS	M6481*	GAABD					A	
32	EXTERNAL RECPTACLE	M6481*	GAABE					A	
33	INTERCOMM STATION LS-460	M6712F	GAABF					A	
34	UHF COMM COAX RELAY	M63181C0	GAABG					A	
35	AMP REL ASSY AM-3624/ARA-50	M631****	GAAAD					A	
36	TAKE COMMAND RELAY PANEL	M6712H	GAABJ					A	
39	FWD HEADSET	M64816	GAAAN					5	
40	AFT HEADSET	M64816	GAAAP					5	
41	RAD RCV-TRNS RT-793/ASQ	M6319***	GAAAB					A	
42	RADIO RCV R-1286/ARR-69	M6334100	GAAAC					A	
43	UHF COMM ANTENNAS	M6312N	GAAAJ					A	
	*AIRCREW INFO EXCHANGE	M	GAAC	GAAD	GAA				000000000
46	AUDIO AMPLIFIER	M6481*	GAABA					A	
47	CONTROL UNIT	M6481*	GAABC					A	
48	HEAD SET MICROPHONE ADAPERS	M6481*	GAABD					A	
51	FWD HEADSET	M64816	GAAAN					A	
52	AFT HEADSET	M64816	GAAAP					A	
	*MODE SELECT	M	GAAD	L	GAAA				FAAAAAAAAA
		M	GAAD	KBA	GAAB				FAAAAAAAAA
		M	GAAD	KBB	GAAC				FAAAAAAAAA
			GAAD		GAA				SAAAAAAAAA
56	INTERCOMM STATION LS-459	M6712E	GAABA					A	
57	UHF-ICS SWITCH	M6481*	GAABB					A	
58	ICS FOOTSWITCH	M6481*	GAABC					A	
59	COMM ANTENNA SELECTOR SWTCH	M631****	GAAAG					A	
60	RADIO SET CONTROL	M633414*	GAAAA					A	
61	CNI-NAV COMP SWITCH	M6712***	GAADC					A	
62	DATA LINK CONTROL PANEL	M6******	GAADD					A	
63	INTERCOMM STATION LS-460	M6712F	GAABF					A	
64	IDENTIFICATION	M	GAB	GABA	GA				000000000
65		M	GAB	GABB					
66	*NORMAL MODE	M	GABA	GABAA	GAB				000000000
67	*SIGNAL RECEPTION + DECODING	M	GABAA	GABAB	GABA				000000000
68	CODER-RCVR-TRANSMITTER	M65210	GABAAA					A	
69	IFF ANTENNA	M652**	GABAAB					A	
70	*SIGNAL TRANSMISSION + CODNG	M	GABAB	GABC	GABAA				000000000
71	CODER-RCVR-TRANSMITTER	M65210	GABABA					A	
72	IFF ANTENNA	M652**	GABABB					A	
	MODE SELECT	M	GABC	L	GABBB				FAAAAAAAAA
74		M	GABC	KAC	GABAB				FAAAAAAAAA
75		M	GABC	KBA	GAB				SAAAAAAAAA
76	TRANSPONDER CONTROL SET	M65290	GABCA					A	
77	*EMERGENCY MODE	M	GABB	GABBA	GAB				000000000
	SIGNAL RECEPTION + DECODING	M	GABBA	GABBB	GABB				AAAAAAAAA
79	CODER-RECVR-TRANSMITTER	M65210	GABAAA					A	
80	IFF ANTENNA	M652**	GABAAB					A	
81	EMERGENCY IFF RELAY	M652**	GABBAB					A	
82	EMERGENCY SWITCHES	M652**	GABBAC					A	

83	•SIGNAL TRANSMISSION • CODING		0ABEB	0ADC	0ADDA		[illegible]
84	CODER-DECOR-TRANSMITTER	[illegible]	0ABFBA				[illegible]
85	IFF ANTENNA	[illegible]	0ABFAB				[illegible]
86	EMERGENCY RELAY	M4S2••	0ABBAB				A
87	EMERGENCY SWITCHES	M4S2••	0ABBAC				A
	•NAVIGATION	M	0AC	0ACA	0A		002000200
		M	0AC	EB0	MBK	)	AAAAAAAAA
		M	0AC	EBR			
		M	0AC	EBS			
		M	0AC	EBT			
	•INFORMATION DISPLAY	M	0ACA	M	0AC		AAAAAAAAA
90		M	0ACA	0ACAA			
91		M	0ACA	0ACAB			
	•STRNG GRNTN • STAB CONTROL	M	0ACAA	C	0ACA		AAAAAAAAA
		M	0ACAA	0ACAC	0BA		000000000
94		M	0ACAA	L			
	•DATA COLLECT/PROCESS/EXCHNGM		0ACAC	0ACAE	0ACAA		FAAAAAAAAA
		M	0ACAC	0ACAD	0ACAB		FAAAAAAAAA
		M	0ACAC		0BAA		F000000000
			0ACAC		0BA		S000000000
			0ACAC		0ACA		SAAAAAAAAA
98	DATA LINK SYSTEM	M4••••••	0ACACA				A
99	AIR DATA COMPUTER SET	M66480	0ACACB				A
A1	TACAN NAVIGATIONAL SET	M71480	0ACACC				A
A2	ATITUDE REF BOMB COMPTR SET	M73110	0ACACD				A
A3	NAVIGATIONAL COMPUTER SET	M73490	0ACACE				A
A4	FLIGHT CONTROL GROUP	M67000	0ACACF				A
A5	FLIGHT DIRECTOR GROUP	M71790	0ACACG				A
A6	MISSILE CONTROL SYSTEM	M78500	0ACACH				A
A7	ELECTRONIC ALTIMETER SET	M72•••	0ACACJ				A
A8	ELINT SYSTEM	M7••••	0ACACK				A
A9	INTERROGATOR SET	M66320	0ACACL				A
B1	VERTICAL FLIGHT REF SET	M64860	0ACACM				A
B2	COMMUNICATION SYSTEM	M6••••	0AA				A
B3	VARIABLE INLET DUCTRAMP SYS	M11310	BD				A
B4	BYPASS BELLMOUTH SYSTEM	M29A10	BF				A
	•BEARING/DIS/MEARING CONT.	M	0ACAB	0AC4C	0ACA		AAAAAAAAA
		M	0ACAB		0BA		000000000
	•WEAPON HOLDING • RELS MECHSM		0BAA	0ACAC	0BA		000000000
	MISSILE LAUNCHERS	M75100	0BAAA				A
	WEAPON ADAPTERS	M75200	0BAAB				A
	BOMB RACKS • HOISTS	M75300	0BAAC				A
	ARMAMENT PODS	M75400	0BAAD				A
	MISSILE PYLONS	M75700	0BAAE				A
	MK 4 GUN POD SYSTEM	M75800	0BAAF				A
	•MODE SELECTION	M	0ACAD	L	0ACAC		AAAAAAAAA
C6		M	0ACAD	M6			
C7		M	0ACAD	0ACAE			
	TACAN ANTENNA SELECT SWITCH	M714••	0ACADA				A
	MODE SELECTOR CONTROL	M7••••	0ACADB				A
	CNI-NAV COMP SWITCH	M6712•••	0AADCC				A
	RADIO SET CONTROL	M6334140	0AAA				A
	TACAN NAV SET CONTROL	M714••	0ACACC				A
	BOMB MODE SWITCH	M6716•••	0ACADF				A
	COMPUTER CONTROL	M73•••	0ACADG				A
	NAV SET CONTROL	M73•••	0ACADH				A
	COMPASS SYSTEM CONTROLLER	M73•••	0ACADJ				A
	ATTITUDE INDICATOR	M5111C	0ACADK				A
	AUTOMATIC FLT CNTL SYS PANL	M7••••	0ACADL				A
	AUX ARMAMENT CNTL PANEL	M79•••	0ACADM				A
	MULTIPLE WEAPONS CNTL PANEL	M79•••	0ACADN				A
	BOMB CONTROL PANEL	M75•••	0ACADP				A
	MISSILE CONTROL PANEL	M75•••	0ACADQ				A
	COMPASS SYSTEM CONTROL PANL	M73•••	0ACADR				A
	CON-NAV GROUP CONTROL PANEL	M73•••	0ACADS				A
	NAV COMPUTER PANEL	M73•••	0ACADT				A
	CONTROL STICK ASSY	M14110	CCMB				A
	•ELECT POWER REG AND DIST	M	0ACAE	KAA	0ACAD		FAAAAAAAAA
		M	0ACAE	KAB	0ACAC		AAAAAAAAA
F2		M	0ACAE	KAC			
F3		M	0ACAE	KAD			
F4		M	0ACAE	KBA			
F5		M	0ACAE	KBB			
F6		M	0ACAE	KBC			
F7		M	0ACAE	KBD			
F8		M	0ACAE	KBE			
F9		M	0ACAE	KAE			
01		M	0ACAE	KAH			
02	MULTIPLE WEAPONS RELAY PANL	M74984	0ACAEA				A
03	NO 2 MISC RELAY PANEL	M42112	0ACAEB				A
F4	LEFT UTILITY PANEL	M748••	0ACAEC				A

29526

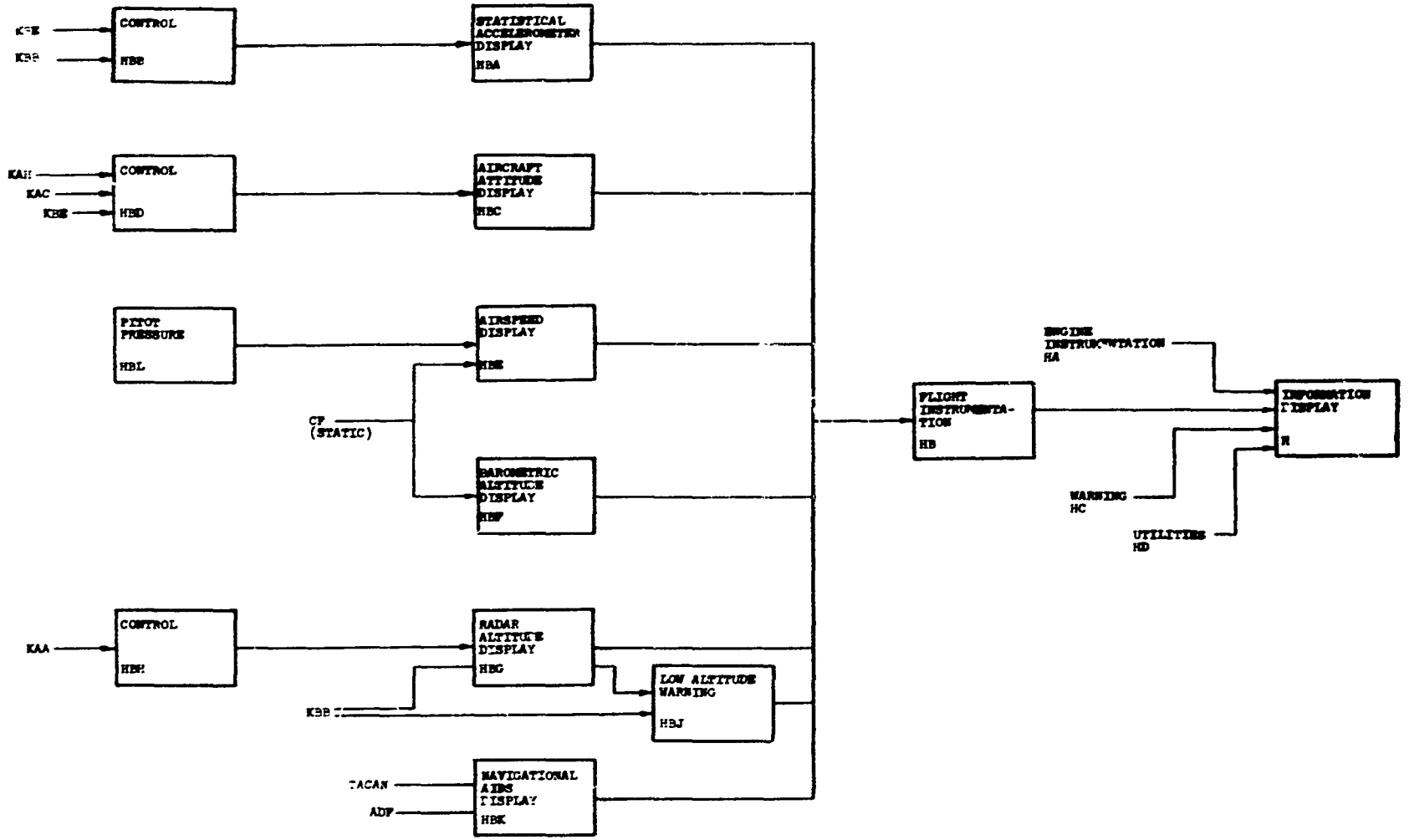
```
65 RIGHT UTILITY + CIR BAR PNLM748**   6ACAED                    A
66 NO 1 CIRCUIT BREAKER PANEL MM2151   6ACAEE                    A
67 NO 2 CIRCUIT BREAKER PANEL MM2152   6ACAEF                    A
68 AUX NO 2 MISSILE FIR RL PNLM749B6   6ACAEG                    A
69*WEAPONS DELIVERY          M         6B       6BA    6          000000000
H1*INFORMATION DISPLAY       M         6BA      M      6B         000000000
H2                           M         6BA      6ACAA
H3                           M         6BA      6ACAB
H4                           M         6BA      6BAA
```

H. INFORMATION DISPLAY SECTION



Aircraft: F-4J		
Title: Functional Diagram INFORMATION DISPLAY SECTION		
Document: NA	rev. date NA	
Date: 23 Apr 1968		

Section H



Aircraft:	**F-4J**
Title:	**Functional Diagram** FLIGHT INSTRUMENTATION (PI)
Document:	NAVAIR 01-245FL8-2-4.1 **rev. date**
Date:	23 Apr 1969

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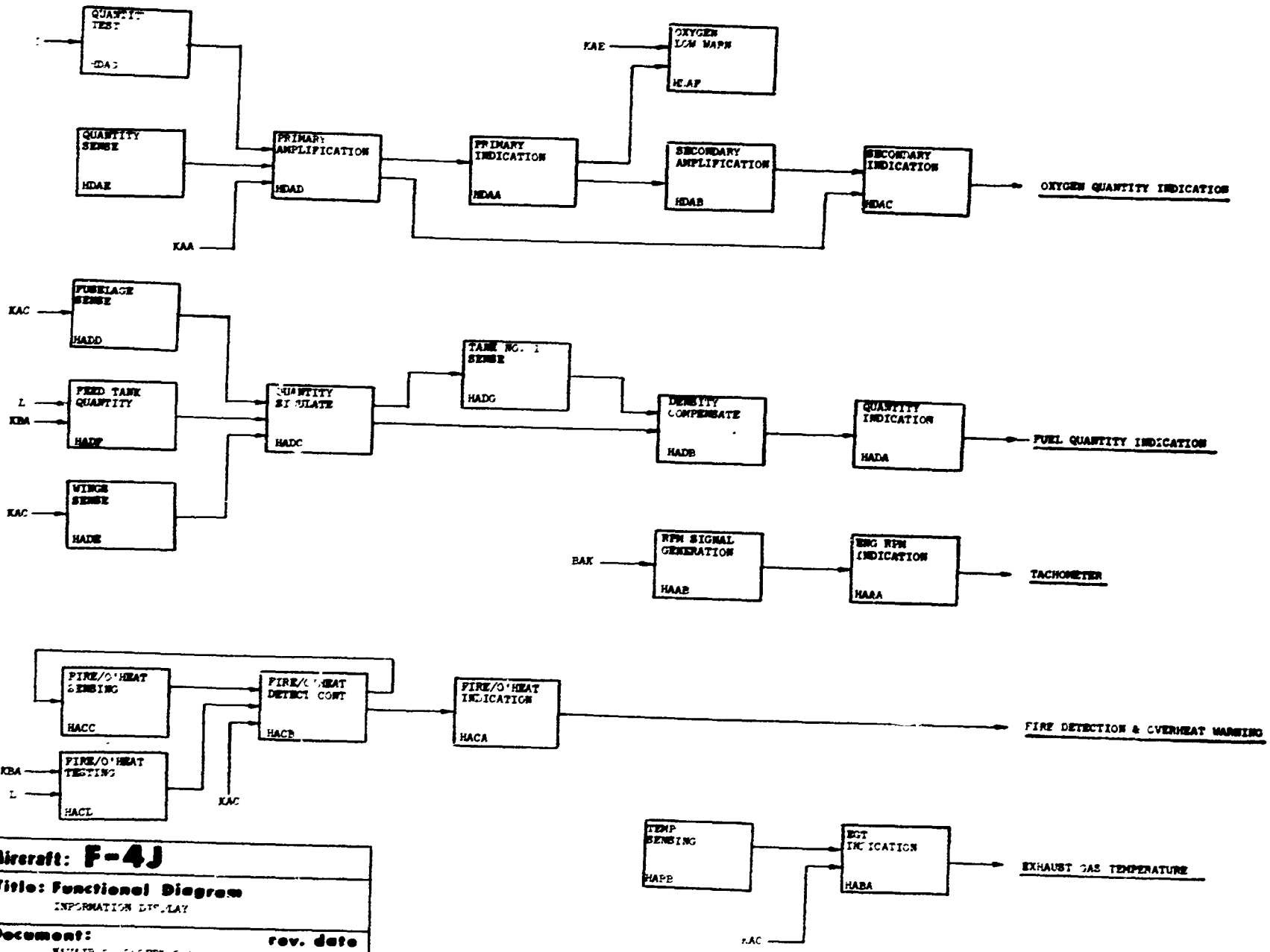
Section H-1 (sheet 1)



Aircraft: F-4J

Title: Functional Diagram

INFORMATION DISPLAY

Document: NAVAIR [illegible]

rev. date [illegible] Mar 1968

Date: [illegible]

Section H-1 (Sheet 1)

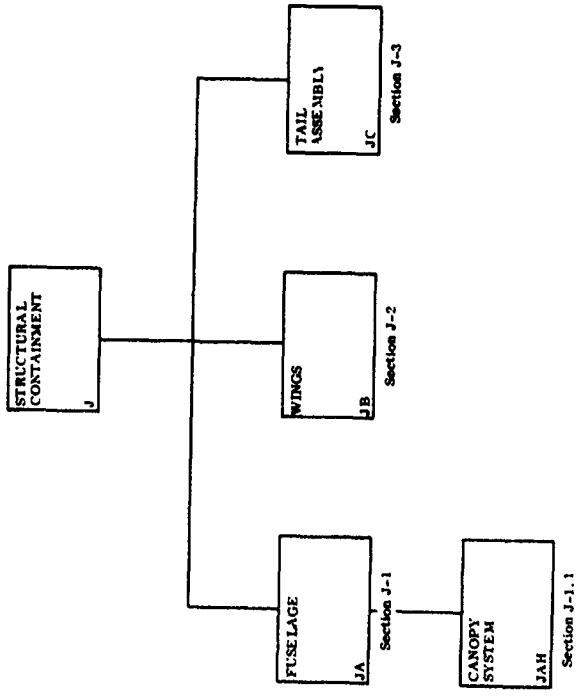
INFORMATION DISPLAY

	TITLE	WUC	ALPHA	INPUT	DEP FUNC	CD FC	AL FN	SENSITIVITY W 123456789
	INFORMATION DISPLAY		H	HA	L			AAAAAAAAA
			H	HB				
			H	HDAA				
			H	HDAC				
			H	HDAF				
	ENGINE INSTRUMENTATION		HA	HAAA	H			AAAAAAAAA
			HA	HABA				
			HA	HACA				
			HA	HADA				
	ENGINE RPM INDICATION	R	RHAAA	RHAAB	HA			0A1222210
	ENGINE RPM INDICATION	R	LHAAA	LHAAB	HA			0A2222210
02	TACHOMETER INDICATOR	R51411	RHAAAA				A	
	TACHOMETER INDICATOR	R51411	LHAAAA				A	
	RPM SIGNAL GENERATION	R	RHAAB	RBAK	RHAAA			AAAAAAAAA
04	TACHOMETER GENERATOR	R51412	RHAABA				A	
	RPM SIGNAL GENERATION	R	LHAAB	LBAK	LHAAA			AAAAAAAAA
	TACHOMETER GENERATOR	R51412	LHAABA				A	
	EXHAUST GAS TEMP INDICATION	R	RHABA	RHABB	HA			0A5555500
	EXHAUST GAS TEMP INDICATION	R	LHABA	LHABB	HA			0A5555500
06		R	RHABA	KAC				
		R	LHABA	KAC				
07	TEMP INDICATOR	R51423	RHABAA				A	
	TEMP INDICATOR	R51423	LHABAA				A	
	TEMP SENSING	R	RHABB		RHABA			AAAAAAAAA
		R	RHABB		RBABC			0A5555500
09	THERMOCOUPLE	R51424	RHABBA				A	
	TEMP SENSING	R	LHABB		LHABA			AAAAAAAAA
		R	LHABB		LBABC			0A5555500
	THERMOCOUPLE	R51424	LHABBA				A	
	FIRE/OVERHEAT INDICATION	R	LHACA	HACB	HA			AAAAAAAAA
11	L FIRE WARNING LIGHT	R49112	LHACAA				A	
12	L OVERHEAT WARNING LIGHT	R49122	LHACAB				A	
	FIRE/OVERHEAT INDICATION	R	RHACA	HACB	HA			AAAAAAAAA
11	2 FIRE WARNING LIGHT	R49112	RHACAA				A	
12	R OVERHEAT WARNING LIGHT	R49122	RHACAB				A	
	DETECTOR CONTROL	R	HACB	HACD	HACA			AAAAAAAAA
		R	HACB	KAC	HACC			AAAAAAAAA
		R	HACB	HACC				
	CONTROL UNIT LH FIRE	R49111	LHACBA				A	
	CONTROL UNIT RH FIRE	R49111	RHACBA				A	
17	CONTROL UNIT LH OVERHEAT	R49121	LHACBB				A	
18	CONTROL UNIT RH OVERHEAT	R49121	RHACBB				A	
	FIRE/OVERHEAT SENSING	R	HACC	HACB	HACB			AAAAAAAAA
	L FIRE DETECTOR HARNESS	R49118	LHACCA				A	
	R FIRE DETECTOR HARNESS	R49118	RHACCA				A	
22	L OVERHEAT DETECTOR HARNESS	R49123	LHACCB				A	
23	R OVERHEAT DETECTOR HARNESS	R49123	RHACCB				A	
	FIRE/OVERHEAT TESTING	R	HACD	L	HACB			A44444444
25		R	HACD	KBA				
26	TEST SWITCH	R49113	HACDA				A	
	FUEL QUANTITY INDICATION	R	HADA	HADB	HA			A002589A0
28	FUEL QUANTITY INDICATOR	R51844	HADAA				A	
	DENSITY COMPENSATION	R	HADB	HADC	HADA			AAAAAAAAA
30		R	HADB	HADG				
31	REFERENCE CONDENSOR	R518**	HADBA				2	
	QUANTITY SIMULATION	R	HADC	HADD	HADB			AAAAAAAAA
		R	HADC	HADE	HADG			FAAAAAAAAA
34		R	HADC	HADF				
35	FUEL QUANTITY SIMULATOR	R51843	HADCA				A	
	FUSELAGE TANKS QUANT SENSE	R	HADD	KAC	HADC			AAAAAAAAA
37	TANK NO 7 FUEL PROBE	R51842	HADDA				1	
38	TANK NO 6 FUEL PROBE	R51842	HADDB				1	
39	TANK NO 6 FUEL PROBE	R51842	HADDC				1	
40	TANK NO 4 FUEL PROBE	R51842	HADDD				1	
41	TANK NO 3 FUEL PROBE	R51842	HADDE				1	
42	TANK NO 2 FUEL PROBE	R51842	HADDF				1	
43	TANK NO 1 UPPER FUEL PROBE	R51842	HADDG				2	
44	TANK NO 1 REF CONDENSOR	R518**	HADBA				2	
	WING TANKS SENSING	R	HADE	KAC	HADC			AAAAAAAAA
46	R O/B FUEL PROBE	R51842	HADEA				2	
47	R INT FUEL PROBE	R51842	HADEB				2	
48	R I/B FUEL PROBE	R51842	HADEC				2	
49	L O/B FUEL PROBE	R51842	HADED				2	
50	L INT FUEL PROBE	R51842	HADEE				2	
51	L I/B FUEL PROBE	R51841	HADEF				2	
	*FEED TANK QUANTITY INDICATER	R	HADF	L	HADC			AAAAAAAAA
53		R	HADF	KBA				
54	FEED TANK CHECK SWITCH	R51844	HADFA				A	
	TANK NO 1 QUANTITY SENSING	R	HADG	HADC	HADB			AAAAAAAAA
56	TANK NO 1 UPPER PROBE	R51842	HADDG				A	

57	TANK NO 1 REF CONDENSOR	R5184*	HADBA				A	
	PRIMARY LOX QUANTITY IND	R	HDAA	HDAD	HDAB			AAAAAAAAA
		R	HDAA		HDAF			AAAAAAAAA
		R	HDAA		H			00AAAAA00
60	LOX QUANTITY INDICATOR	R51851	HDAAA				A	
	REPEATER LOX QUANTITY IND	R	HDAC	HDAB	H			00AAAAA00
		R	HDAC	HDAD				
63	LOX QUANTITY INDICATOR	R51851	HDACA				A	
	PRIMARY AMPLIFICATION	R	HDAD	HDAE	HDAA			AAAAAAAAA
		R	HDAD	HDAG	HDAC			AAAAAAAAA
65		R	HDAD	KAA				
66	QUANTITY AMPLIFIER	R4721F	HDADA				A	
	REPEATER AMPLIFICATION	R	HDAB	HDAA	HDAC			AAAAAAAAA
68		R	HDAB	KAA				
69	QUANTITY AMPLIFIER	R4721E	HDABA				A	
	LOX QUANTITY SENSING	R	HDAE		HDAD			AAAAAAAAA
71	QUANTITY PROBE	R47117	HDAEA				A	
	LOX LOW WARNING	R	HDAF	HDAA	H			002222200
72		R	HDAF	KAE				
73	LOX LOW WARNING LIGHT	R47213	HDAFA				1	
74	MASTER CAUTION TEST RELAY	R4711*	HDAFB				1	
75	MASTER CAUTION TEST SWITCH	R4711*	HDAFC				1	
	LOX QUANTITY SYSTEM TEST	R	HDAG	L	HDAD			AAAAAAAAA
	SYSTEM TEST SWITCH	R5185*	HDAGA				1	
	FLIGHT INSTRUMENTATION		HB	HBA	H			AAAAAAAAA
			HB	HBC				
			HB	HBE				
			HB	HBK				
			HB	HBF				
			HB	HBG				
			HB	HBJ				
	*STATISTICAL ACCEL DISPLAY	S51112	HBA	HBB	HB	F		000111100
	CONTROL	S	HBB	KBE	HBA			AAAAAAAAA
03		S	HBB	KBB				
04	TRANSDUCER	S51142	HBBA				A	
05	POWER RELAY	S5114*	HBBB				A	
06	RMLG SCISSOR SWITCH	S13145	RDABABQ				A	
07	NLG LIMIT SWITCH	S13143	DAABAA				A	
08	*ATTITUDE DISPLAY	S	HBC	HHD	HB	E		045555560
09	AOA INDICATOR	S56861	HBCA				A	
10	ATTITUDE DIRECTOR INDICATOR	S73124	HBCB				A	
11	STANDBY ATTITUDE INDICATOR	S5111F	HBCC				A	
12	REMOTE ATTITUDE INDICATOR	S5111C	AHBCD				A	
	CONTROL	S	HBD	KAH	HBC			AAAAAAAAA
14		S	HBD	KAC				
15		S	HBD	KBE				
16	GYRO CUT-OUT SWITCH	S5111*	HBDA				A	
17	EMER POWER RELAY	S5111*	HBDB				A	
	*AIRSPEED DISPLAY	S	HBE	CF	HB	E		0A11111A0
19		S	HBE	HBL				
20	TRUE AIRSPEED INDICATOR	S51114	FHBEA				A	
21	TRUE AIRSPEED INDICATOR	S51114	AHBEB				A	
22	A/S AND MACH NO. INDICATOR	S51113	FHBEC				A	
23	A/S AND MACH NO. INDICATOR	S51113	AHBED				A	
	NAV AIDS DISPLAY	S	HBK	GAC	HB	E		002555550
25	STANDBY COMPASS	S51212	HBKA				A	
26	CLOCK	S51211	HBKB				A	
27	CLOCK	S51211	FHBKC				A	
28	BDHI	S511**	AHBKD				A	
29	HORIZ SITUATION INDICATOR	S511**	FHBKE				A	
30	*BAROMETRIC ALTITUDE DISPLAY	S	HBF	CF	HB	E		011111220
31	ALTIMETER	S51111	FHBFA				A	
32	ALTIMETER	S51111	AHBFB				A	
33	VERTICAL VELOCITY INDICATOR	S51115	HBFC				A	
34	*RADAR ALTITUDE DISPLAY	S	HBG	HBH	HB	E		011111220
		S	HBG	KBB	HBJ			011111220
36	HEIGHT INDICATOR	S72362	HBGA				A	
	*LOW ALTITUDE WARNING	S	HBJ	KBB	HB	E		011111220
		S	HBJ	HBG				
	LIGHT	S72362*	HBJA				A	
	CONTROL	S	HBH	KAA	HBG			AAAAAAAAA
39	5 AMP CKT BREAKER	S4215*	HBHA				A	
40	5 AMP CKT BREAKER	S4215*	HBHB				A	
	PITOT PRESSURE	S	HBL		HBE			0A11111A0
42	PITOT/STATIC TUBE	S51136	HBLA				A	

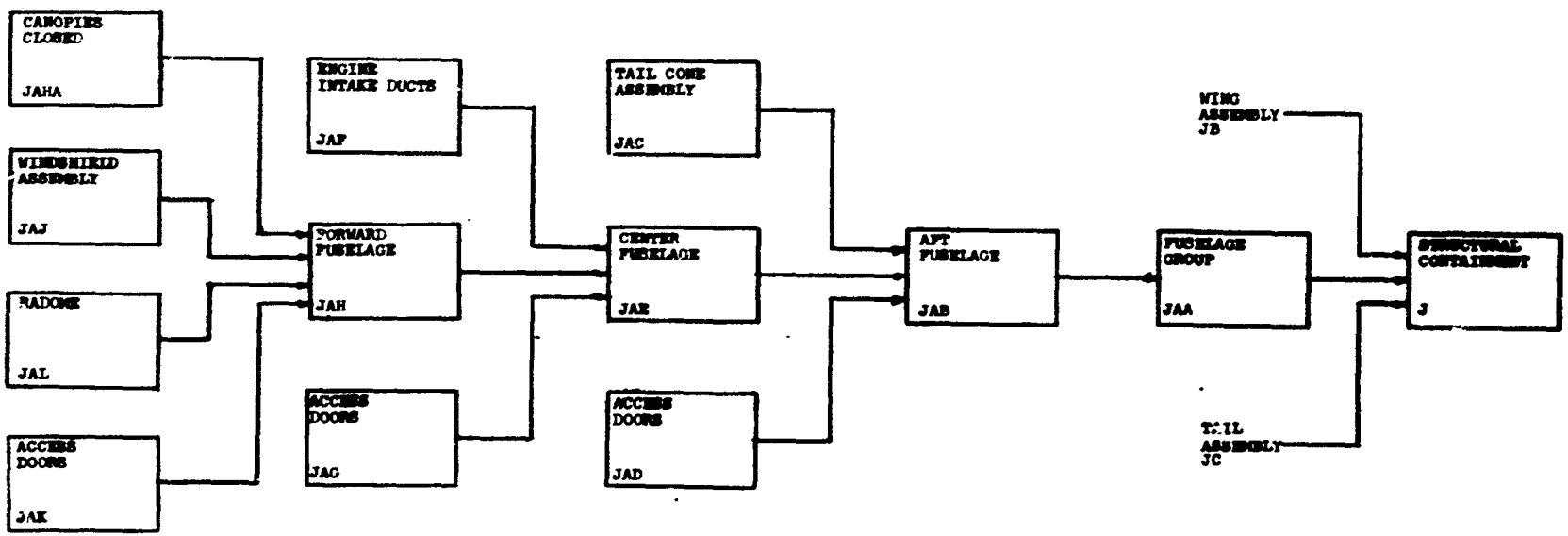
29527

J. STRUCTURAL CONTAINMENT SECTION

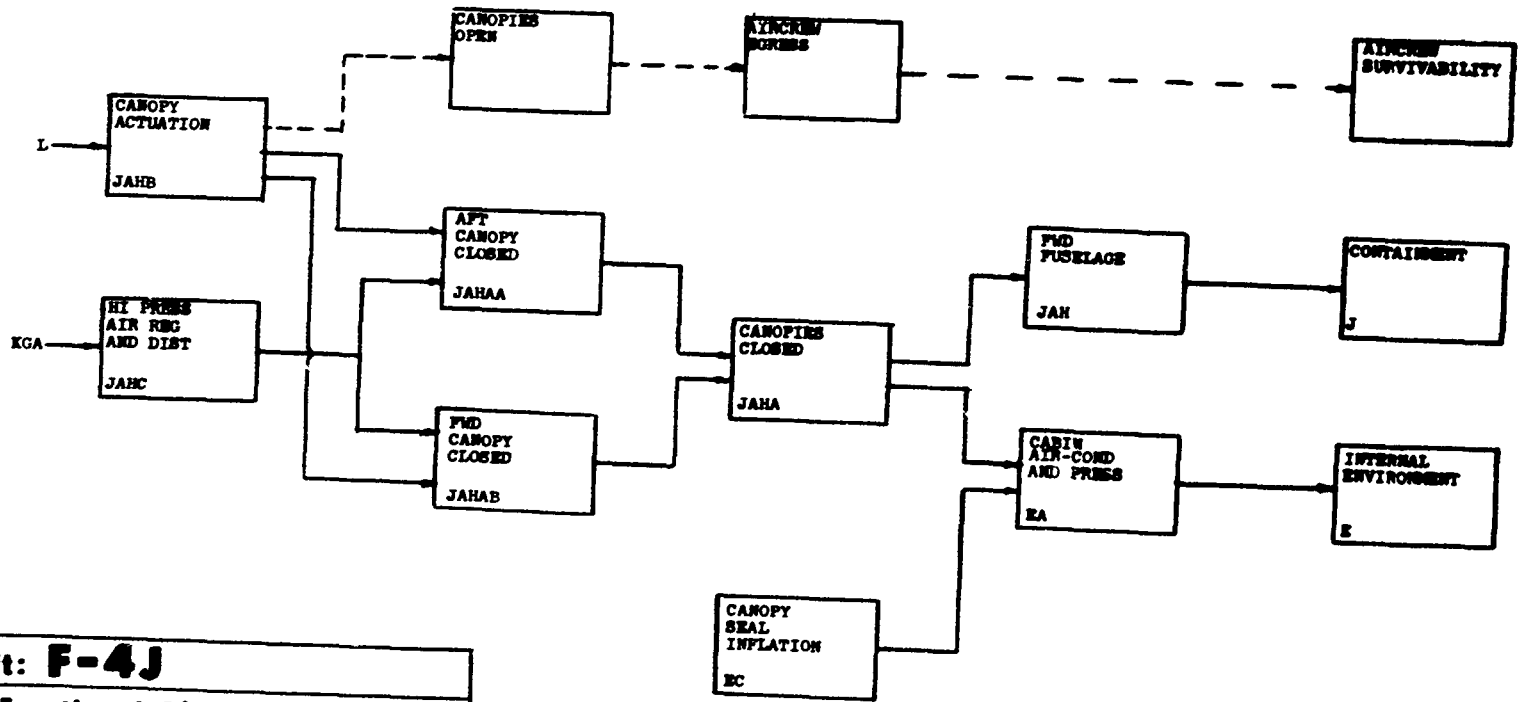


Aircraft: F-4J	
Title: Functional Diagram	STRUCTURAL CONTAINMENT SECTION
Document: NA	rev. date NA
Date: 23 Apr 1969	

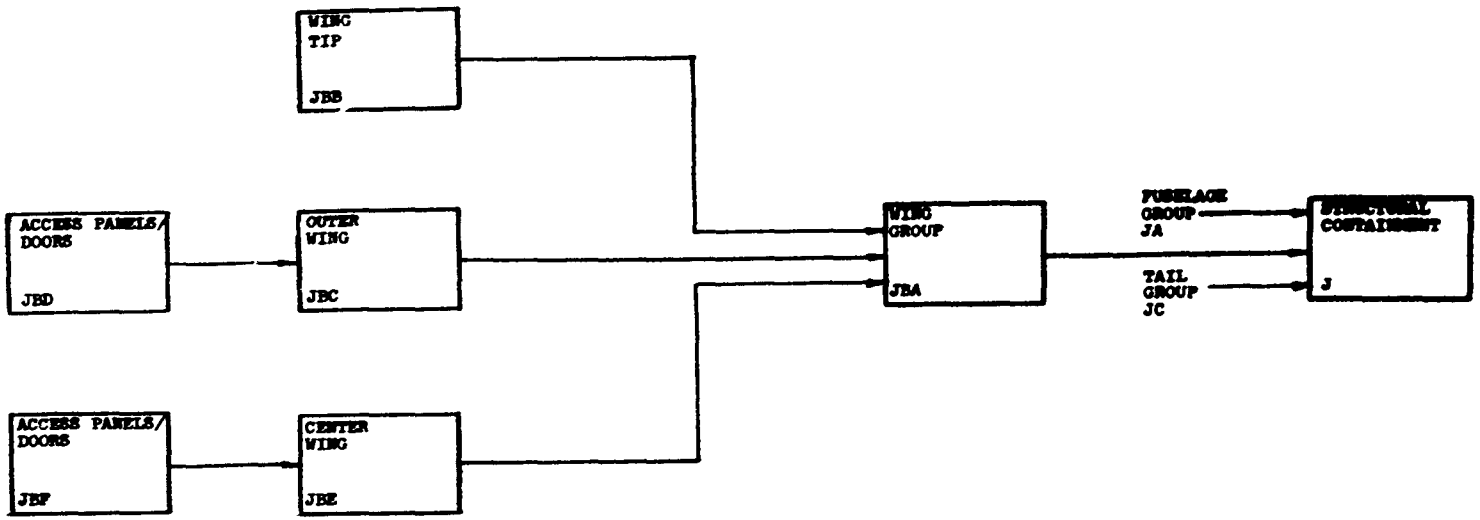
Section J



Aircraft: F-4J	
Title: Functional Diagram FUSELAGE GROUP (JA)	
Document: NAVAIR 01-245FDB-2-2.2	**rev. date** 15 Jun 1968
Date: 23 Apr 1969	

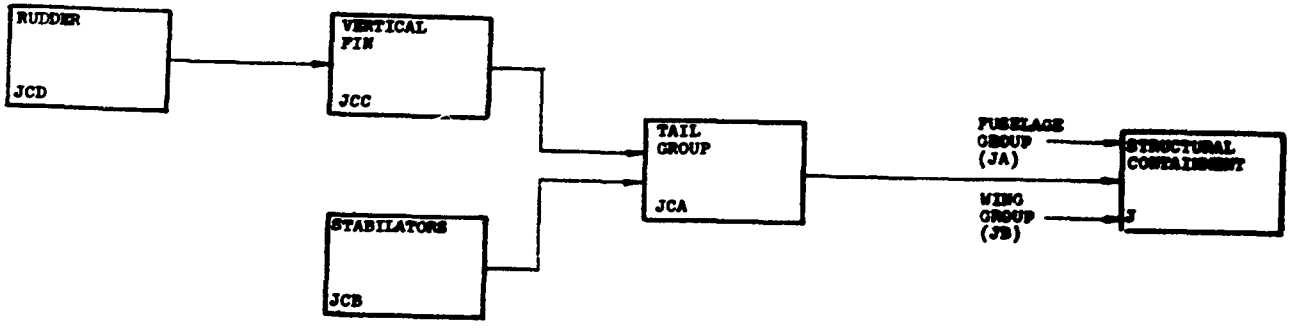


Aircraft: F-4J	
Title: Functional Diagram CANOPY SYSTEM	
Document: NAVAIR 01-245FDB-1	**rev. date** 1 Nov 1967
Date: 23 Apr 1969	



Aircraft: F-4J	
Title: Functional Diagram STRUCTURAL CONTAINMENT (J) WING GROUP (JB)	
Document: NAVAIR 01-245FDB-2-2.2	**rev. date** 25 Feb 1969
Date: 23 Apr 1969	

Section J-2

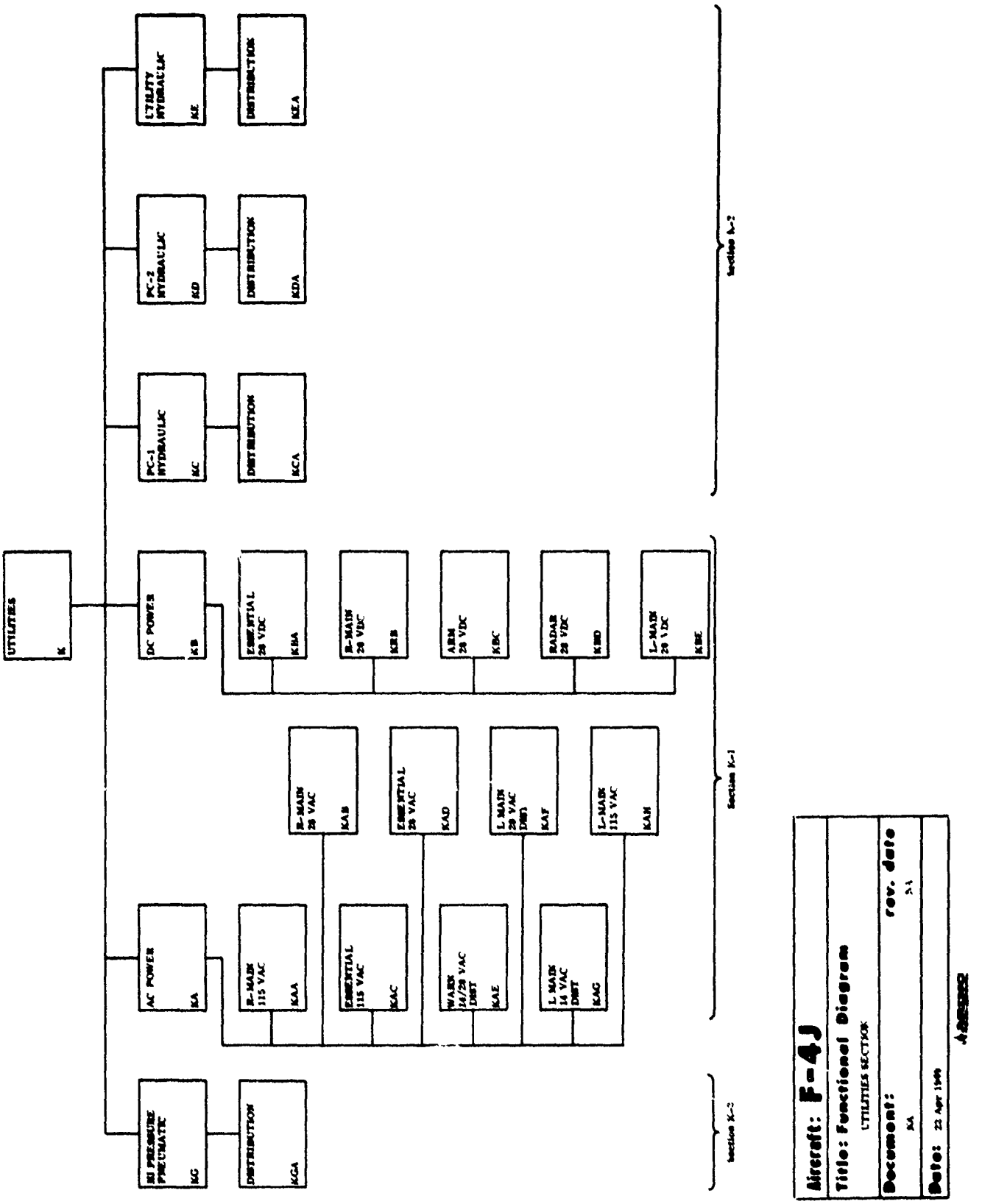


Aircraft: F-4J	
Title: Functional Diagram STRUCTURAL CONTAINMENT (J) TAIL ASSEMBLY (JC)	
Document:	**rev. date** 26 Feb 1969
Date: 23 Apr 1969	

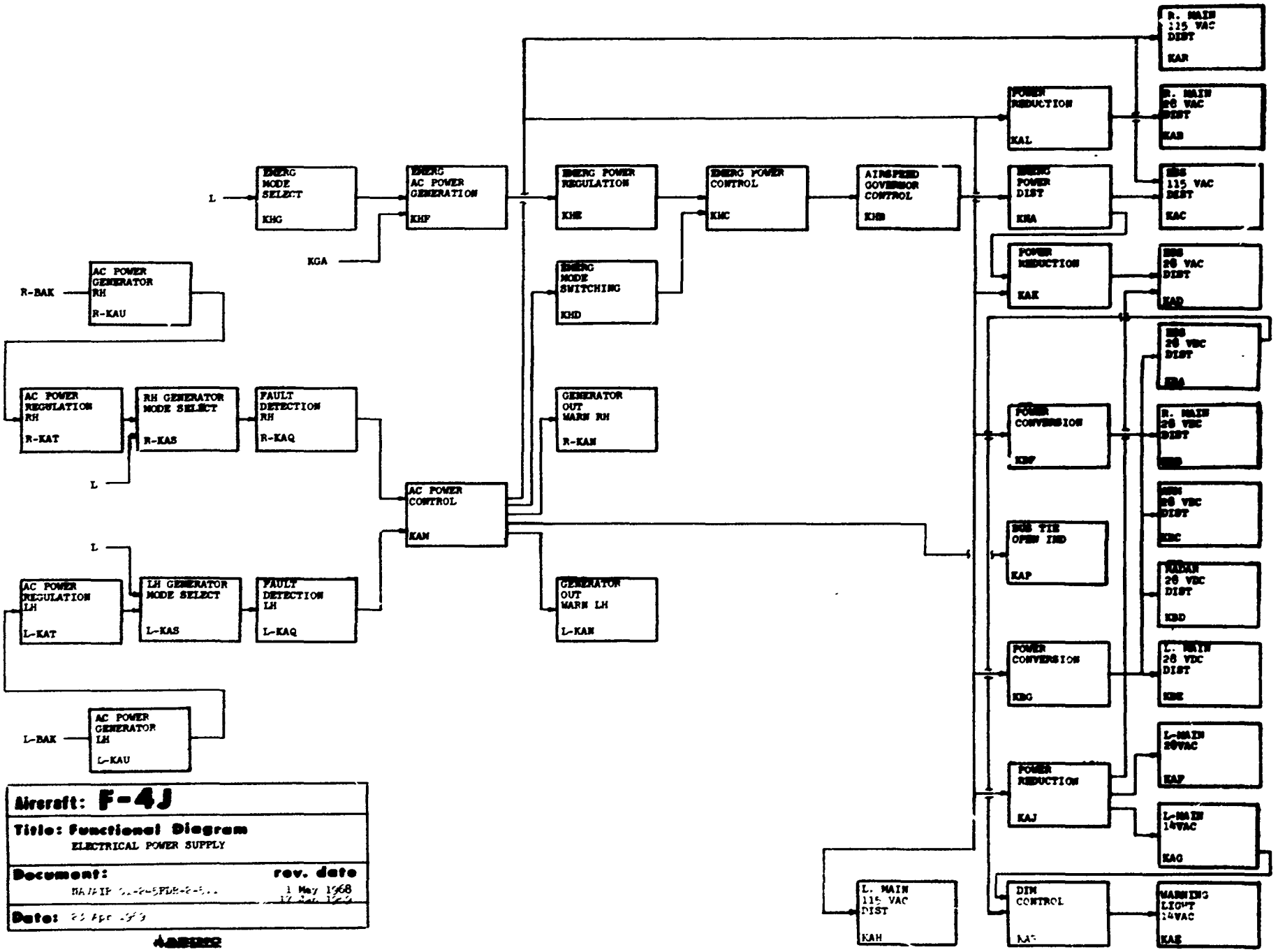
STRUCTURAL CONTAINMENT

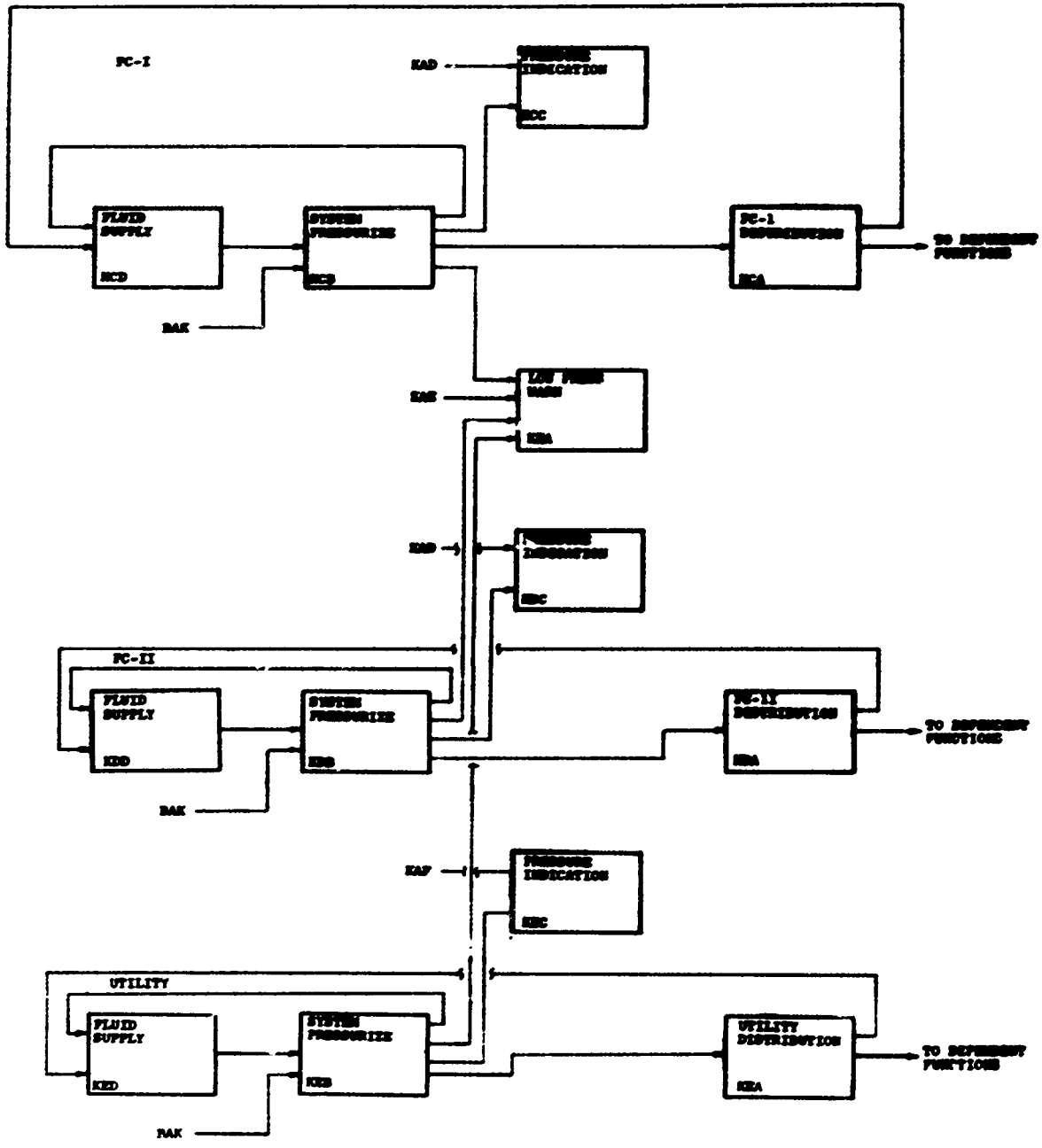
	TITLE	WUC	ALPHA	INPUT	DEP FUNC	CD FC	AL FN	W	SENSITIVITY 123456789
	STRUCTURAL CONTAINMENT		J	JAA					AAAAAAAAA
			J	JBA					
			J	JCA					
			J	JAH					
01	FUSELAGE GROUP	V	JAA	JAB	J				AAAAAAAAA
	AFT FUSELAGE	V	JAB	JAC	JAA				AAAAAAAAA
03		V	JAB	JAD					
04		V	JAB	JAE					
	TAIL CONE ASSEMBLY	V	JAC		JAB				AAAAAAAAA
	ACCESS DOORS	V	JAD		JAB				011111110
	CENTER FUSELAGE	V	JAE	JAF	JAB				AAAAAAAAA
08		V	JAE	JAG					
08		V	JAE	JAH					
	ENGINE INTAKE DUCTS	V	JAF		JAE				AAAAAAAAA
	ACCESS DOORS	V	JAG		JAE				011111110
	FORWARD FUSELAGE	V	JAH	JAJ	JAE				AAAAAAAAA
12		V	JAH	JAK	J				
12		V	JAH	JAL					
		V	JAH	JAHA					
	WINDSHIELD ASSEMBLY	V	JAJ		JAH				AAAAAAAAA
14	CANOPY	V111B400	JAJA				A		
15	SIDE PANELS	V1111410R	JAJB				A		
16	SIDE PANELS	V1111420L	JAJC				A		
	ACCESS DOORS	V	JAK		JAH				011111110
18	GROUP ONE	V11120	JAKA				A		
	GROUP TWO	V11130	JAKB				A		
	RADOME	V	JAL		JAH				022222220
	*CANOPIES CLOSED	V	JAHA	JAHAA	JAH				039999930
		V	JAHA	JAHAB	EA				AAAAAAAAA
	AFT CANOPY CLOSED	V	JAHAA	JAHC	JAHA				AAAAAAAAA
54		V	JAHAA	JAHB					
55	LATCH	V123A2	JAHAAA				A		
56	RELEASE	V123A3	JAHAAB				A		
57	CABLE MECHANISM	V123A4	JAHAAC				A		
58	BELLCRANK	V123A5	JAHAAD				A		
59	BUNGEE/SPRING	V123A6	JAHAAE				A		
60	LINK/ARM	V123A7	JAHAAF				A		
	FWD CANOPY CLOSED	V	JAHAB	JAHC	JAHA				AAAAAAAAA
62		V	JAHAB	JAHB					
63	LATCH	V123A2	JAHABA				A		
64	RELEASE	V123A3	JAAABB				A		
65	CABLE MECHANISM	V123A4	JAHABC				A		
66	BELLCRANK	V123A5	JAHABD				A		
67	BUNGEE/SPRING	V123A6	JAHABE				A		
68	LINK/ARM	V123A7	JAHABF				A		
	HI PRESS AIR REG AND DIST	V	JAHC	KGA	JAHAA				FAAAAAAAAA
		V	JAHC		JAHAB				FAAAAAAAAA
			JAHC		JAHA				SAAAAAAAAA
71	RESTRICTOR VALVE	V12311	JAHCA				A		
72	SELECTOR VALVE	V12312	JAHCB				A		
73	RELIEF VALVE	V12313	JAHCC				A		
74	MANIFOLD	V12314	JAHCD				A		
75	RETRACT CYLINDER	V12315	JAHCE				A		
76	PANEL RELEASE CYLINDER	V12316	JAHCF				A		
77	STICK RELEASE CYLINDER	V12317	JAHCG				A		
78	PRESSURE OPERATING VALVE	V12318	JAHCH				A		
79	SHUTTLE VALVE	V1231A	JAHCJ				A		
80	DOUBLE CHECK VALVE	V1231C	JAHCK				A		
81	REGULATOR	V1231D	JAHCL				A		
	CANOPY ACTUATION	V	JAHB	L	JAHAA				FAAAAAAAAA
		V	JAHB	KAE	JAHAB				FAAAAAAAAA
			JAHB		JAHA				SAAAAAAAAA
	WING GROUP	V	JBA	JBB	J				AAAAAAAAA
	WING TIP	V	JBB	JBC	JBA				055555550
	OUTER WING	V	JBC	JBD	JBA				
04		W	JBC	JBE					
	ACCESS PANELS/DOORS	V	JBD		JBC				011111110
	CENTER WING	V	JBE	JBF	JBA				AAAAAAAAA
	ACCESS PANELS/DOORS	V	JBF		JBE				011111110
01	*TAIL GROUP	X	JCA	JCB	J				AAAAAAAAA
	STABILATOR	X	JCB		JCA				AAAAAAAAA
	VERTICAL FIN	X	JCC	JCD	JCA				AAAAAAAAA
	RUDDER	X	JCD		JCC				AAAAAAAAA

K. UTILITIES SECTION



Section K


L
EMERG MODE SELECT KHG
EMERG AC POWER GENERATION KHF
KGA
EMERG POWER REGULATION KHE
EMERG POWER CONTROL KHC
AIRSPEED GOVERNOR CONTROL KHB
EMERG MODE SWITCHING KHD
R. MAIN 115 VAC DIST KAR
POWER REDUCTION KAL
R. MAIN 26 VAC DIST KAB
EMERG POWER DIST KHA
115 VAC DIST KAC
POWER REDUCTION KAK
26 VAC DIST KAD
R-BAK
AC POWER GENERATOR RH R-KAU
26 VDC DIST KBA
AC POWER REGULATION RH R-KAT
RH GENERATOR MODE SELECT R-KAS
FAULT DETECTION RH R-KAQ
GENERATOR OUT MARN RH R-KAN
POWER CONVERSION KBF
R. MAIN 26 VDC DIST KBB
L
AC POWER CONTROL KAN
26 VDC DIST KBC
L
BUS TIE OPEN IND KAP
26 VDC DIST KBD
AC POWER REGULATION LH L-KAT
LH GENERATOR MODE SELECT L-KAS
FAULT DETECTION LH L-KAQ
GENERATOR OUT MARN LH L-KAN
POWER CONVERSION KBG
L. MAIN 26 VDC DIST KBE
L-BAK
AC POWER GENERATOR LH L-KAU
L-MAIN 26VAC KAF
POWER REDUCTION KAJ
L-MAIN 14VAC KAG
L. MAIN 115 VAC DIST KAH
DIM CONTROL KAT
WARNING LIGHT 14VAC KAS
Aircraft: F-4J
Title: Functional Diagram
ELECTRICAL POWER SUPPLY
Document:
rev. date
1 May 1968
Date:



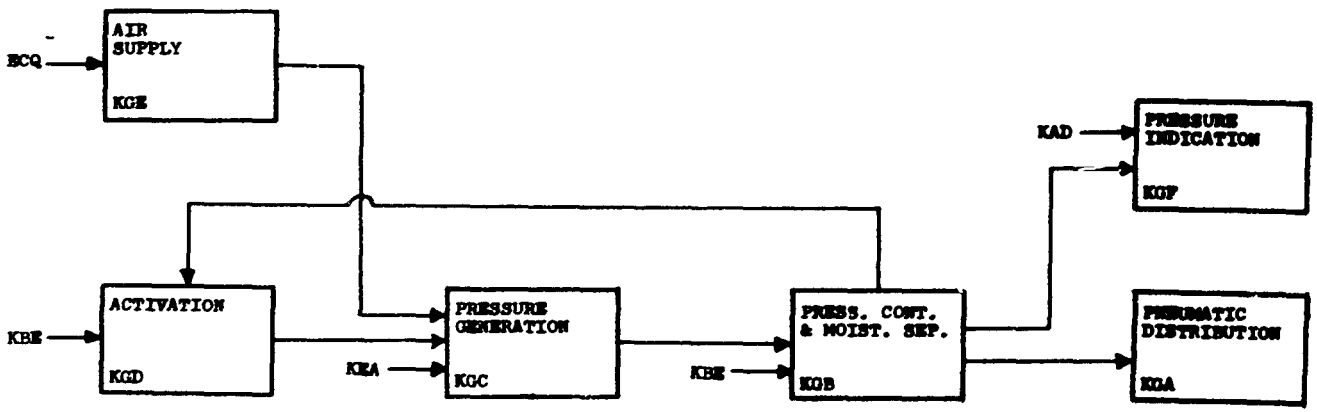
Aircraft: F-4J

Title: Functional Diagram
HYDRAULIC POWER

Document: NAVAIR 01-245FDB-2-2.4 rev. date 15 Mar 1968

Date: 23 Apr 1969

Section K-2



Aircraft: F-4J	
Title: Functional Diagram HI-PRESSURE PNEUMATIC SYSTEM	
Document: NAVAIR 01-245FDB-2-2.4	**rev. date** 15 Mar 1968
Date: 23 Apr 1969	

TITLE	WUC	ALPHA K	INPUT KA	DEP FUNC	CD FC	AL FN	SENSITIVITY W 1234567
UTILITIES							AAAAAAAAA
AC POWER CONTROL	Y	KAM	RKA0	KAA			FAAAAAAAAA
	Y	KAM	LKA0	KAL			FAAAAAAAAA
	Y	KAM		KAC			FAAAAAAAAA
	Y	KAM		KAK			FAAAAAAAAA
	Y	KAM		KAJ			FAAAAAAAAA
	Y	KAM		KAP			FAAAAAAAAA
	Y	KAM		KBF			FAAAAAAAAA
	Y	KAM		KBG			FAAAAAAAAA
	Y	KAM		KAH			FAAAAAAAAA
	Y	KAM		KHD			AAAAAAAAA
	Y	KAM		RKAN			AAAAAAAAA
	Y	KAM		LKAN			AAAAAAAAA
AC POWER CONTROL		KAM		AACE		KHC	S888888888
		KAM		AAAG		KHC	S888888888
		KAM		ABBC		HC	S888888888
		KAM		B		KHC	S888888888
		KAM		CB		KHC	S888888888
		KAM		CC		HC	S888888888
		KAM		CA		KHC	S888888888
		KAM		DAE		KHC	S888888888
		KAM		EA		KHC	S888888888
		KAM		EB		KHC	S888888888
		KAM		EE		KHC	S888888888
		KAM		FAG		KHC	S888888888
		KAM		FBH		KHC	S888888888
		KAM		FCC		KHC	S888888888
		KAM		GAA		KHC	S888888888
		KAM		GAB		KHC	S888888888
		KAM		GAC		KHC	S888888888
		KAM		HA		KHC	S888888888
		KAM		HB		KHC	S888888888
06 AC POWER CONTROL BOX	Y42128	KAMA					A
07 GENERATOR CONTROL PANEL	Y42127	KAMB					A
RIGHT MAIN 115 VAC DISTRIB	Y	KAA	KAM	HBH			AAAAAAAAA
		KAA		K			AAAAAAAAA
	Y	KAA		HDAD			FAAAAAAAAA
	Y	KAA		HDAB			AAAAAAAAA
	Y	KAA		GACAE			AAAAAAAAA
	Y	KAA		FBH			AAAAAAAAA
	Y	KAA		EBPO			AAAAAAAAA
	Y	KAA		EAAD			FAAAAAAAAA
	Y	KAA		EAAB			FAAAAAAAAA
	Y	KAA		EAAC			FAAAAAAAAA
		KAA		EA			SAAAAAAAAA
	Y	KAA		GGBA			AAAAAAAAA
	Y	KAA		BBP			AAAAAAAAA
	Y	KAA		BDC			AAAAAAAAA
	Y	KAA		CBX			AAAAAAAAA
	Y	KAA		LCCF			AAAAAAAAA
		KAA		RCCF			AAAAAAAAA
	Y	KAA		BGRR			FAAAAAAAAA
		KAA		CC			SAAAAAAAAA
AC BUS	Y4212H	KAAA					A
RIGHT MAIN 28VAC DISTRIB	Y	KAB	KAL	FBH			AAAAAAAAA
		KAB		K			AAAAAAAAA
	Y	KAB		EEE			AAAAAAAAA
	Y	KAB		GACAE			AAAAAAAAA
	Y	KAB		CBX			AAAAAAAAA
AC BUS	Y4212H	KABA					A
ESSENTIAL 115VAC DISTRIB	Y	KAC	KAM	RBAEC			FAAAAAAAAA
ESSENTIAL 115VAC DISTRIB	Y	KAC	KAM	LBAEC			FAAAAAAAAA
		KAC		B			S00AAAAA00
		KAC		K			AAAAAAAAA
	Y	KAC	KHA	GACAE			AAAAAAAAA
	Y	KAC		HABA			AAAAAAAAA
	Y	KAC		GABC			AAAAAAAAA
	Y	KAC		EEE			AAAAAAAAA
	Y	KAC		HADD			FAAAAAAAAA
	Y	KAC		HADE			FAAAAAAAAA
		KAC		HADC			SAAAAAAAAA
	Y	KAC		HBD			AAAAAAAAA
	Y	KAC		BBB			AAAAAAAAA
	Y	KAC		HACB			AAAAAAAAA
AC BUS	Y4212H	KACA					A
ESSENTIAL 28VAC DISTRIB	Y	KAD	KAK	EEE			AAAAAAAAA
		KAD		K			AAAAAAAAA
	Y	KAD	KAJ	GACAE			AAAAAAAAA
	Y	KAD		BBE			AAAAAAAAA
	Y	KAD		KCC			AAAAAAAAA
	Y	KAD		KDC			AAAAAAAAA

	Y	KAD		RBADE		AAAAAAAAA
	Y	KAD		LBADE		AAAAAAAAA
	Y	KAD		KBF		AAAAAAAAA
	Y	KAD		RBCB		AAAAAAAAA
	Y	KAD		LBCB		AAAAAAAAA
	Y	KAD		CBH		AAAAAAAAA
	Y	KAD		LCCJ		AAAAAAAAA
	Y	KAD		RCCJ		AAAAAAAAA
AC BUS	Y42128H	KADA			A	
ESSENTIAL 28VDC DISTRIB	Y	KBA	KBF	CDBJ		AAAAAAAAA
		KBA		K		AAAAAAAAA
	Y	KBA		RBADB		FAAAAAAAAA
	Y	KBA		LBADB		FAAAAAAAAA
	Y	KBA	KBB	RBABA		AAAAAAAAA
	Y	KBA	KBB	LBABA		AAAAAAAAA
	Y	KBA		CCH		AAAAAAAAA
	Y	KBA		CAB		AAAAAAAAA
	Y	KBA		KAR		AAAAAAAAA
	Y	KBA		HACD		AAAAAAAAA
	Y	KBA		HADF		AAAAAAAAA
	Y	KBA		BACAE		AAAAAAAAA
	Y	KBA		BABC		AAAAAAAAA
	Y	KBA		BAAD		AAAAAAAAA
	Y	KBA		EEE		AAAAAAAAA
	Y	KBA		LBBA		FAAAAAAAAA
	Y	KBA		RBBA		FAAAAAAAAA
	Y	KBA		BBN		AAAAAAAAA
	Y	KBA		BBF		AAAAAAAAA
	Y	KBA		BBP		AAAAAAAAA
DC BUS	Y42138	KBAA			A	
RIGHT MAIN 28VDC DISTRIB	Y	KBB	KBF	BBN		AAAAAAAAA
	Y	KBB	KBB	BBC		FAAAAAAAAA
	Y	KBB		EBPC		AAAAAAAAA
	Y	KBB		EBPD		AAAAAAAAA
	Y	KBB		EBAC		AAAAAAAAA
	Y	KBB		EBPB		AAAAAAAAA
	Y	KBB		EAAC		AAAAAAAAA
	Y	KBB		EAAB		FAAAAAAAAA
	Y	KBB		EAAF		FAAAAAAAAA
	Y	KBB		EAAK		FAAAAAAAAA
	Y	KBB		EAAD		AAAAAAAAA
	Y	KBB		EAAJ		FAAAAAAAAA
	Y	KBB		DAE		AAAAAAAAA
	Y	KBB		FAE		AAAAAAAAA
	Y	KBB		GAAD		AAAAAAAAA
	Y	KBB		GACAE		AAAAAAAAA
	Y	KBB		HBB		AAAAAAAAA
	Y	KBB		HBG		AAAAAAAAA
	Y	KBB		HBJ		FAAAAAAAAA
	Y	KBB		CBF		AAAAAAAAA
	Y	KBB		ABAG		AAAAAAAAA
	Y	KBB		RBEF		AAAAAAAAA
	Y	KBB		LBEF		AAAAAAAAA
	Y	KBB		CDBD		AAAAAAAAA
DC BUS	Y42138	KBBA			A	
ARMAMENT 28VDC DISTRIBUTION	Y	KBC	KBF	GACAE		AAAAAAAAA
		KBC		K		AAAAAAAAA
	Y	KBC	KBA			
DC BUS	Y42138	KBCA			A	
RADAR 28VDC DISTRIBUTION	Y	KBD	KBF	GACAE		AAAAAAAAA
		KBD		K		AAAAAAAAA
	Y	KBD	KBG	KBG		AAAAAAAAA
DC BUS	Y42138	KBDA			A	
LEFT MAIN 28VDC DISTRIB	Y	KBE	KBG	KBG		AAAAAAAAA
		KBE		K		AAAAAAAAA
	Y	KBE	KBF	HBD		AAAAAAAAA
	Y	KBE		HBB		AAAAAAAAA
	Y	KBE		GACAE		AAAAAAAAA
	Y	KBE		FBH		AAAAAAAAA
	Y	KBE		FCC		AAAAAAAAA
	Y	KBE		BBC		AAAAAAAAA
	Y	KBE		BGBD		FAAAAAAAAA
	Y	KBE		BGBB		FAAAAAAAAA
	Y	KBE		BGBA		FAAAAAAAAA
	Y	KBE		KGB		AAAAAAAAA
	Y	KBE		KGD		FAAAAAAAAA
	Y	KBE		AACE		AAAAAAAAA
	Y	KBE		ABUC		AAAAAAAAA
	Y	KBE		BGAR		AAAAAAAAA
	Y	KBE		CAE		AAAAAAAAA
DC BUS	Y42138	KBEA			A	

39529

LEFT MAIN 28VAC DISTRIB	Y	KAF	KAJ	FBH	AAAAAAAAA
		KAF		K	AAAAAAAAA
	Y	KAF	KAK		
AC BUS	Y4212H	KAFA			A
LEFT MAIN 14VAC DISTRIB	Y	KAG	KAJ	EEE	AAAAAAAAA
		KAG		K	AAAAAAAAA
	Y	KAG	KAK	KAR	AAAAAAAAA
AC BUS	Y4212H	KAGA			A
WARNING 14/28VAC DISTRIB	Y	KAE	KAR	AACE	AAAAAAAAA
		KAE		K	AAAAAAAAA
	Y	KAE		RBCH	AAAAAAAAA
	Y	KAE		LBCH	AAAAAAAAA
	Y	KAE		CDBJ	AAAAAAAAA
	Y	KAE		RBEE	AAAAAAAAA
	Y	KAE		LBEE	AAAAAAAAA
	Y	KAE		ARDF	AAAAAAAAA
		KAE		LCEJ	FAAAAAAAAA
		KAE		RCEJ	FAAAAAAAAA
	Y	KAE		RBEB	AAAAAAAAA
	Y	KAE		LBEB	AAAAAAAAA
	Y	KAE		KFA	AAAAAAAAA
	Y	KAE		BBP	FAAAAAAAAA
	Y	KAE		BRR	AAAAAAAAA
	Y	KAE		BBK	AAAAAAAAA
	Y	KAE		BGBC	AAAAAAAAA
	Y	KAE		EBPD	AAAAAAAAA
	Y	KAE		EBPC	FAAAAAAAAA
	Y	KAE		GACAE	AAAAAAAAA
	Y	KAE		EEE	AAAAAAAAA
	Y	KAE		FAK	AAAAAAAAA
	Y	KAE		FCG	AAAAAAAAA
	Y	KAE		HDAF	AAAAAAAAA
	Y	KAE		JAHB	AAAAAAAAA
		KAE		CEK	AAAAAAAAA
AC BUS	Y4212H	KAEA			A
LIGHT DIMING CONTROL	Y	KAR	KBA	KAE	AAAAAAAAA
	Y	KAR	KAG		
LIGHT CONTROL PANEL	Y44112	KARA			A
LEFT AMIN 115VAC DISTRIB	Y	KAH	KAM	HBD	AAAAAAAAA
		KAH		K	AAAAAAAAA
	Y	KAH		EEE	AAAAAAAAA
	Y	KAH		FAH	FAAAAAAAAA
	Y	KAH		FAG	AAAAAAAAA
	Y	KAH		FAD	FAAAAAAAAA
	Y	KAH		FAB	FAAAAAAAAA
	Y	KAH		FAC	FAAAAAAAAA
	Y	KAH		FAA	FAAAAAAAAA
	Y	KAH		GACAE	AAAAAAAAA
	Y	KAH		BBB	AAAAAAAAA
	Y	KAH		BBC	FAAAAAAAAA
	Y	KAH		ABAF	AAAAAAAAA
	Y	KAH		RBARC	AAAAAAAAA
	Y	KAH		LBARC	AAAAAAAAA
AC BUS	Y4212H	KAHA			A
AC POWER CONVERSION		KBF		KM	SAAAAAAAAA
AC POWER CONVERSION	Y	KBF	KAM	KBA	FAAAAAAAAA
	Y	KBF	KHA	KBB	FAAAAAAAAA
	Y	KBF		KBC	FAAAAAAAAA
	Y	KBF		KBD	FAAAAAAAAA
	Y	KBF		KBE	FAAAAAAAAA
TRANSFORMER RECTIVIER	Y42131	KBFA			A
AC POWER CONVERSION	Y	KBG	KAM	KBA	FAAAAAAAAA
	Y	KBG	KHA	KBB	FAAAAAAAAA
	Y	KBG		KBC	FAAAAAAAAA
	Y	KBG		KBD	FAAAAAAAAA
	Y	KBG		KBE	FAAAAAAAAA
		KBG		KM	SAAAAAAAAA
TRANSFORMER RECTIFIER	Y42131	KBGA			A
AC POWER REDUCTION	Y	KAK	KAM	KAD	FAAAAAAAAA
	Y	KAK	KHA	KAF	FAAAAAAAAA
	Y	KAK		KAG	FAAAAAAAAA
		KAK		KN	SAAAAAAAAA
28VAC AUTO TRANSFORMER	Y4212D	KAKA			A
POWER REDUCTION		KAL	KAM	KAB	AAAAAAAAA
		KAL		K	AAAAAAAAA
AC POWER REDUCTION	Y	KAJ	KAM	KAD	FAAAAAAAAA
	Y	KAJ	KHA	KAF	FAAAAAAAAA
	Y	KAJ		KAG	FAAAAAAAAA
		KAJ		KN	SAAAAAAAAA
28VAC AUTO TRANSFORMER	Y4212D	KAJA			A
BUS TIE OPEN INDICATION	Y	KAP	KAM	H	011111110

64	BUS TIE OPEN LIGHT	Y42120	KAPA				1	
	R GENERATOR OUT WARNING	Y	RKAN	KAM	H			011111110
66	R GENERATOR WARNING LIGHT	Y42120	RKANA				1	
	L GENERATOR OUT WARNING	Y	LKAN	KAM	H			011111110
68	L GENERATOR WARNING LIGHT	Y42120	LKANA				1	
	R GENERATOR FAULT DETECTION	Y	RKAQ	RKAS	KAM			AAAAAAAAA
	L GENERATOR FAULT DETECTION	Y	LKAQ	LKAS	KAM			AAAAAAAAA
	R GENERATOR MODE SELECT	Y	RKAS	RKAT	RKAQ			AAAAAAAAA
		Y	RKAS	L				
	PILOT GENERATOR CONT PANEL	Y42122	KASA				A	
	L GENERATOR MODE SELECT	Y	LKAS	LKAT	LKAQ			AAAAAAAAA
		Y	LKAS	L				
	PILOT GENERATOR CONT PANEL	Y42122	KASA				A	
	R GEN POWER REGUALTION	Y	RKAT	RKAU	RKAS			AAAAAAAAA
	R VOLTAGE REG SUPERV PANEL	Y42120	RKATA				A	
	R STATIC EXCITER REGULATOR	Y42125	RKATB				A	
	L GEN POWER REGULATION	Y	LKAT	LKAU	LKAS			AAAAAAAAA
	L VOLTAGE REG SUPERV PANEL	Y4212	LKATA				A	
	L STATIC EXCITER REGULATOR	Y4212	LKATB				A	
	R AC POWER GENERATION	Y	RKAU	RBAK	RKAT			666666666
		Y	RKAU	BCE				
	RH GENERATOR	Y42121	RKAUA				A	
	RH CONSTANT SPEED DRIVE	Y42210	RKAUB				A	
	L AC POWER GENERATION	Y	LKAU	LBAK	LKAT			666666666
	LH GENERATOR	Y42121	LKAUA				A	
		Y	LKAU	BCE				
	LH CONSTANT SPEED DRIVE	Y42210	LKAUB				A	
	*EMERG AC POWER DISTRIBUTION	Y	KHA	KHB	KAC	K KA		AAAAAAAAA
		Y	KHA		KAK			AAAAAAAAA
		Y	KHA		KBF			AAAAAAAAA
		Y	KHA		KBG			AAAAAAAAA
		Y	KHA		KAJ			AAAAAAAAA
	AIRSPEED GOVERNOR CONTROL	Y	KHB	KHC	KHA			AAAAAAAAA
93	AIRSPEED SWITCH	Y42143	KHBA				A	
	EMERGENCY POWER CONTROL	Y	KHC	KHE	KHB			FAAAAAAAAA
	EMERGENCY POWER CONTROL		KHC		AACE	K KAM		SAAAAAAAAA
			KHC		ABAG	K AM		SAAAAAAAAA
			KHC		ABBC	K KAM		SAAAAAAAAA
			KHC		B	K KAM		SAAAAAAAAA
			KHC		CB	K AM		SAAAAAAAAA
			KHC		CC	K KAM		SAAAAAAAAA
			KHC		CA	K KAM		SAAAAAAAAA
			KHC		DAE	K KAM		SAAAAAAAAA
			KHC		EA	K KAM		SAAAAAAAAA
			KHC		EB	K KAM		SAAAAAAAAA
			KHC		EE	K KAM		SAAAAAAAAA
			KHC		FAG	K KAM		SAAAAAAAAA
			KHC		FBH	K KAM		SAAAAAAAAA
			KHC		FCC	K KAM		SAAAAAAAAA
			KHC		GAA	K KAM		SAAAAAAAAA
			KHC		GAB	K KAM		SAAAAAAAAA
			KHC		GAC	K KAM		SAAAAAAAAA
			KHC		HA	K KAM		SAAAAAAAAA
			KHC		HB	K KAM		SAAAAAAAAA
95		Y	KHC	KHD				
96	GENERATOR LOAD/FREQ CONTROL	Y42144	KHCA				A	
97	ESSENTIAL LINE CONTROL	Y42145	KHCB				A	
	EMERGENCY MODE SWITCHING	Y	KHD	KAM	KHC			AAAAAAAAA
99	EMERGENCY GEN CONTACTOR	Y42146	KHDA				A	
	EMERG POWER REGULATION	Y	KHE	KHF	KHC			AAAAAAAAA
A1	EMERG CONTROL REGULATOR	Y42142	KHEA				A	
	EMERG AC POWER GENERATION	Y	KHF	KHG	KHE			AAAAAAAAA
A3		Y	KHF	KGA				
A4	EMERGENCY GENERATOR	Y42141	KHFA				A	
A5	RAM AIR TURBINE	Y4532700	KHFB				A	
A6	PNEUMATIC SEQUENCE VALVE	Y45321	KHFC				A	
A7	RAT DOOR CYLINDER LH	Y45322	KHFD				A	
A8	RAT DOOR CYLINDER RH	Y45322	KHFE				A	
A9	RAT ACTUATOR CYLINDER	Y45323	KHFF				A	
B0	RAT ACTUATOR	Y45325	KHFG				A	
B1	POWER UNIT STRUT	Y4532730	KHFH				A	
B2	SWIVEL ASSEMBLY	Y4532C	KHFJ				A	
	EMERGENCY MODE SELECT	Y	KHG	L	KHF			AAAAAAAAA
B4	MANUAL OPERATING VALVE	Y45311	KHGA				A	
B5	RELEASE HADLE	Y45312	KHGB				A	
B6	RELEASE MECHANISM	Y45313	KHGC				A	
B7	EXTENSION MECHANISM	Y4532D	KHGD				A	
	*POWER CONTROL 1 DISTRIBUTE	Z	KCA	KCB	KCD			AAAAAAAAA
		Z	KCA		CAB			555555555
		Z	KCA		LCCC			F555555555

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	Z	KCA		LCCB	F555553555
		KCA		LCCA	SAAAAAAAAA
04 MANIFOLD	Z4511A	KCAA			A
05 FILTER, STABILATOR	Z4511C	KCAB			3
06 FILTER,SPOILER + AILERON LH	Z4511C	KCAC			3
07 MANIFOLD CHECK VALVE	Z4511*	KCAD			A
08 STABILATOR CHECK VALVE	Z4511*	KCAE			A
SYSTEM PRESSURIZATION	Z	KCB	KCD	KCA	AAAAAAAAA
	Z	KCB	BAK	KCC	AAAAAAAAA
	Z	KCB		KFA	AAAAAAAAA
	Z	KCB		KCD	AAAAAAAAA
12 HYDRAULIC PUMP	Z45112	KCBA			A
13 ACCUMULATOR	Z45115	KCBB			A
14 ACCUMULATOR GAGE	Z45114	KCBC			5
15 SYSTEM RELIEF VALVE	Z45116	KCBD			A
16 SURGE SUPPRESSOR	Z4511*	KCBE			2
FLUID SUPPLY	Z	KCD	KCB	KCB	AAAAAAAAA
18	Z	KCD	KCA		
19 RESERVOIR	Z45113	KCDA			A
20 BLEED VALVE	Z4511*	KCDB			A
21 HYD/FUEL RADIATOR	Z45118	KCDC			A
22 FILTER	Z4511C	KCDD			3
23 RESERVOIR CHECK VALVE	Z4511*	KCDE			A
24 PUMP CASE DRAIN CHECK VALVE	Z4511*	KCDF			A
25 RADIATOR CHECK VALVE	Z4511*	KCDG			A
26 LH AILERON CHECK VALVE	Z4511*	KCDH			A
27 STABILATOR CHECK VALVE	Z4511*	KCDJ			A
PC I PRESSURE INDICATION	Z	KCC	KCB	H	022222220
29	Z	KCC	KAD		
HYDRAULIC FUSE	Z5181*	KCCA			A
PRESSURE TRANSMITTER	Z51812	KCCB			A
PRESSURE INDICATOR	Z51811	KCCC			A
SNUBBER	Z5181*	KCCD			A
5 AMP CIRCUIT BREAKER	Z4215*	KCCE			A
*POWER CONTROL II DISTRIBUTE	Z	KDA	KDB	KDD	AAAAAAAAA
	Z	KDA		CAB	555555555
	Z	KDA		RCCC	F555555555
	Z	KDA		RCCB	F555555555
		KDA		RCCA	SAAAAAAAAA
37 MANIFOLD	Z45126	KDAA			A
38 FILTER, STABILATOR	Z45127	KDAB			3
39 FILTER,SPOILER + AILERON RG	Z45127	KDAC			3
MANIFOLD CHECK VALVE	Z451**	KDAD			A
STABILATOR CHECK VALVE	Z451**	KDAE			A
SYSTEM PRESSURIZATION	Z	KDB	KDD	KFA	AAAAAAAAA
	Z	KDB	BAK	KDC	AAAAAAAAA
	Z	KDB		KDA	AAAAAAAAA
	Z	KDB		KDD	AAAAAAAAA
46 HYDRAULIC PUMP	Z45122	KDBA			A
47 ACCUMULATOR	Z45123	KDBB			A
48 ACCUMULATOR GAGE	Z45124	KDBC			5
49 SYSTEM RELIEF VALVE	Z4512*	KDBD			A
50 SURGE SUPPRESSOR	Z4512*	KDBE			2
FLUID SUPPLY	Z	KDD	KDB	KDB	AAAAAAAAA
52	Z	KDD	KDA		
53 RESERVOIR	Z4512A	KDDA			A
54 BLEED VALVE	Z4512*	KDDB			A
55 HYD/FUEL RADIATOR	Z45128	KDDC			A
56 FILTER	Z45127	KDDD			3
57 RESERVOIR CHECK VALVE	Z4512*	KDDE			A
58 PUMP CASE DRAIN CHECK VALVE	Z4512*	KDDF			A
59 RADIATOR CHECK VALVE	Z4512*	KDDG			A
60 RH AILERON CHECK VALVE	Z4512*	RDDH			A
61 STABILATOR CHECK VALVE	Z4512*	KDDJ			A
PC II PRESSURE INDICATION	Z	KDC	KDB	H	022222220
63	Z	KDC	KAD		
HYDRAULIC FUSE	Z5181*	KDCA			A
PRESSURE TRANSMITTER	Z51814	KDCB			A
PRESSURE INDICATOR	Z51813	KDCC			A
SNUBBER	Z5181*	KDCD			A
5 AMP CIRCUIT BREAKER	Z5181*	KDCE			A
LOW PRESSURE WARNING	Z	KFA	KCB	H	011111110
69	Z	KFA	KDB		
70	Z	KFA	KEB		
71	Z	KFA	KAE		
72 PC I PRESSURE SWITCH	Z45117	KFAA			A
73 PC II PRESSURE SWITCH	Z45125	KFAB			A
74 WARNING LIGHT	Z4512*	KFAC			A
75 5 AMP CIRCUIT BREAKER	Z4215*	KFAD			A
*UTILITY HYD DISTRIBUTION	Z	KEA	KEB	KED	AAAAAAAAA
	Z	KEA		DAC	AAAAAAAAA

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		Z	KEA		LCCD		FAAAAAAAAA
		Z	KEA		RBEC		FAAAAAAAAA
		Z	KEA		LBEC		FAAAAAAAAA
		Z	KEA		RBFC		FAAAAAAAAA
		Z	KEA		LBFC		FAAAAAAAAA
		Z	KEA		BBC		AAAAAAAAA
		Z	KEA		KBC		AAAAAAAAA
		Z	KEA		CBD		FAAAAAAAAA
		Z	KEA		BDC		AAAAAAAAA
		Z	KEA		AABD		AAAAAAAAA
		Z	KEA		CBB		AAAAAAAAA
		Z	KEA		CDBC		AAAAAAAAA
		Z	KEA		AACB		AAAAAAAAA
		Z	KEA		ABBB		AAAAAAAAA
		Z	KEA		CEC		AAAAAAAAA
		Z	KEA		BBP		AAAAAAAAA
		Z	KEA		LCCB		FAAAAAAAAA
		Z	KEA		RCCB		FAAAAAAAAA
		Z	KEA		RCCD		FAAAAAAAAA
		Z	KEA		RCCC		FAAAAAAAAA
		Z	KEA		CBF		FAAAAAAAAA
		Z	KEA		LCCC		FAAAAAAAAA
			KEA		CC		SAAAAAAAAA
		Z	KEA		ABAC		AAAAAAAAA
94	LH AILERON/SPOILER FILTER	Z45136	KEAA			3	
95	RH AILERON/SPOILER FILTER	Z45136	KEAB			3	
96	RUDDER FILTER	Z45136	KEAC			3	
97	MANIFOLD	Z45134	KEAD			A	
98	MANIFOLD CHECK VALVE	Z4513*	KEAE			A	
99	MANIFOLD FILTER	Z45136	KEAF			3	
A3	FILTER CHECK VALVE	Z4513*	KEAG			A	
	SYSTEM PRESSURIZATION	Z	KEB	KED	KED		AAAAAAAAA
		Z	KEB	BAK	KEC		AAAAAAAAA
		Z	KEB		KEA		AAAAAAAAA
		Z	KEB		KFA		AAAAAAAAA
A5	LH HYDRAULIC PUMP	Z4513C	KEBA			5	
A6	RH HYDRAULIC PUMP	Z4513C	KEBB			5	
A7	SYSTEM ACCUMULATOR	Z4513D	KEBC			A	
A8	ACCUMULATOR GAGE	Z45135	KEBD			A	
A9	SYSTEM RELIEF VALVE	Z45131	KEBE			A	
B0	LH PUMP CHECK VALVE	Z4513*	KEBF			A	
B1	RH PUMP CHECK VALVE	Z4513*	KEBG			A	
B2	LH SURGE SUPPRESSOR	Z4513*	KEBH			2	
B3	RH SURGE SUPPRESSOR	Z4513*	KEBJ			2	
	FLUID SUPPLY	Z	KED	KEA	KEB		AAAAAAAAA
B5		Z	KED	KEB			
B6	RESERVOIR	Z4513A	KEDA			A	
B7	RESERVOIR BLEED VALVE	Z4513*	KEDB			A	
B8	LH HYD/FUEL RADIATOR	Z45138	KEDC			A	
B9	RH HYD/FUEL RADIATOR	Z45138	KEDD			A	
C0	RADIATOR RELIEF VALVE	Z4513*	KEDE			A	
C1	LH PUMP CASE DRAIN FILTER	Z45136	KEDF			3	
C2	RH PUMP CASE DRAIN FILTER	Z45136	KEDG			3	
C3	CASE DRAIN CHECK VALVE	Z4513*	KEDH			A	
C4	MANIFOLD FILTER	Z45136	KEDJ			3	
C5	MANIFOLD FILTER	Z45136	KEDK			3	
C6	MANIFOLD CHECK VALVE	Z4513*	KEDL			A	
C7	MANIFOLD CHECK VALVE	Z4513*	KEDM			A	
	PRESSURE INDICATION	Z	KEC	KEB	H		011111110
		Z	KEC	KAF			
	5 AMP CIRCUIT BREAKER	Z4215*	KECA			A	
	HYDRAULIC FUSE	Z4513*	KECB			A	
	SNUBBER	Z4513*	KECD			A	
	PRESSURE TRANSMITTER	Z51816	KECE			A	
	PRESSURE GAGE	Z51815	KECF			A	
	$PNEUMATICS DISTRIBUTION	+	KGA	KGB	KHF		AAAAAAAAA
		+	KGA		DBB		AAAAAAAAA
		+	KGA		DCB		AAAAAAAAA
		+	KGA		JAHC		011111110
		+	KGA		CDBF		AAAAAAAAA
		+	KGA		AABG		AAAAAAAAA
07	GROUND CHARGING AIR VALVE	+45216	KGAA			1	
08	AIR VALVE FILTER	+4521D	KGAB			1	
	PRESS CONT/MOIST SEPARATOR	+	KGB	KBE	KGA		AAAAAAAAA
		+	KGB	KGC	KGF		AAAAAAAAA
		+	KGB		KGD		AAAAAAAAA
12	MOISTURE SEPARATOR	+45211	KGBA			8	
13	CHEMICAL DRIER	+45218	KGBB			4	
14	PRESSURE SENSING SWITCH	+4521*	KGBC			A	
15	VENT VALVE	+4521*	KGBD			A	
16	DUMP VALVE	+4521*	KGBE			A	

17	SAFETY VALVE	+4521F	K0BF			A
	PRESSURE GENERATION	+	K0C	K0D	K0B	AAAAAAAAA
19		+	K0C	KEA		
20		+	K0C	K0E		
21	HYD DRIVE COMPRESSOR	+4521C	K0CA			A
22	HYDRAULIC MOTOR	+4521E	K0CB			A
23	CASE DRAIN CHECK VALVE	+452**	K0CC			A
	SYSTEM ACTIVATION	+	K0D	K0E	K0C	AAAAAAAAA
25		+	K0D	K0B		
26	SELECTOR VALVE	+45215	K0DA			A
27	FLOW REGULATOR	+452**	K0DB			A
28	DOOR NO 22 SWITCH	+452**	K0DC			A
29	DOOR NO 23 SWITCH	+452**	K0DD			A
30	5 AMP CIRCUIT BREAKER	+452**	K0DE			A
	AIR SUPPLY	+	K0E	EC0	K0C	AAAAAAAAA
32	CHECK VALVE AND FILTER	+452**	K0EA			A
33	ABSOLUTE PRESSURE REGULATOR	+45216	K0EB			A
	PRESSURE INDICATION	+	K0F	K0B	H	011111110
35		+	K0F	KAD		
	5 AMP CIRCUIT BREAKER	+452**	K0FA			A
	AIR PRESSURE GAGE	+51821	K0FB			A
	PRESSURE INDICATOR	+51822	K0FC			A
	PRESSURE TRANSMITTER	+51823	K0FD			A
	28 VOLT DC DISTRIBUTION		KM		AACE	SAAAAAAAAA
			KM		ABA6	SAAAAAAAAA
			KM		ABBC	SAAAAAAAAA
			KM		B	SAAAAAAAAA
			KM		CA	SAAAAAAAAA
			KM		CB	SAAAAAAAAA
			KM		CC	SAAAAAAAAA
			KM		BAE	SAAAAAAAAA
			KM		EA	SAAAAAAAAA
			KM		EBPD	SAAAAAAAAA
			KM		EEE	SAAAAAAAAA
			KM		FBH	SAAAAAAAAA
			KM		FCC	SAAAAAAAAA
			KM		GAAD	SAAAAAAAAA
			KM		GABC	SAAAAAAAAA
			KM		GACAE	SAAAAAAAAA
			KM		HADF	SAAAAAAAAA
			KM		HBB	SAAAAAAAAA
			KM		HBG	SAAAAAAAAA
			KM		HBD	SAAAAAAAAA
	AC LOW VOLTAGE DISTRIBUTION		KN		LBADE	SAAAAAAAAA
			KN		RBADE	SAAAAAAAAA
			KN		LBCG	SAAAAAAAAA
			KN		RBCG	SAAAAAAAAA
			KN		RBE	SAAAAAAAAA
			KN		LCCJ	SAAAAAAAAA
			KN		RCCJ	SAAAAAAAAA
			KN		CBH	SAAAAAAAAA
			KN		EEE	SAAAAAAAAA
			KN		GACAE	SAAAAAAAAA
			KN		FBH	SAAAAAAAAA

APPENDIX B

COMPUTER PROGRAMS

This appendix presents the computer programs for the construction and exercising of the Navy F-4J Flight Safety Model. These programs are identified in the following table and described in detail beginning on the page indicated.

Title	Purpose	Page
AS100A	Produces Dictionary and Dependent Function array from functional/sensitivity deck.	B-3
AS101A	Sorts Dictionary tape.	B-9
AS200A	Identifies sensitivity values along either sensitivity or functional paths.	B-11
AS300A	Sorts path/sensitivity tape by WUC, ALPHA, and Provisory Factor.	B-29
AS400A	Combines path sensitivities for each Provisory Factor/WUC combination.	B-33
AS500A	Formatted dump of AS400A in printout and/or punch card form.	B-43
AS600A	Combines sensitivity and failure data for use in AS700A.	B-47
AS700A	Computes WUC criticality	B-51

PROGRAM: AS100A

Inputs: AS100-CD (Function deck)

Output: AS100-T1 (Dictionary tape)
AS100-T2 (Array-tape)
AS100-R1 (Array and dictionary printout)

Purpose:

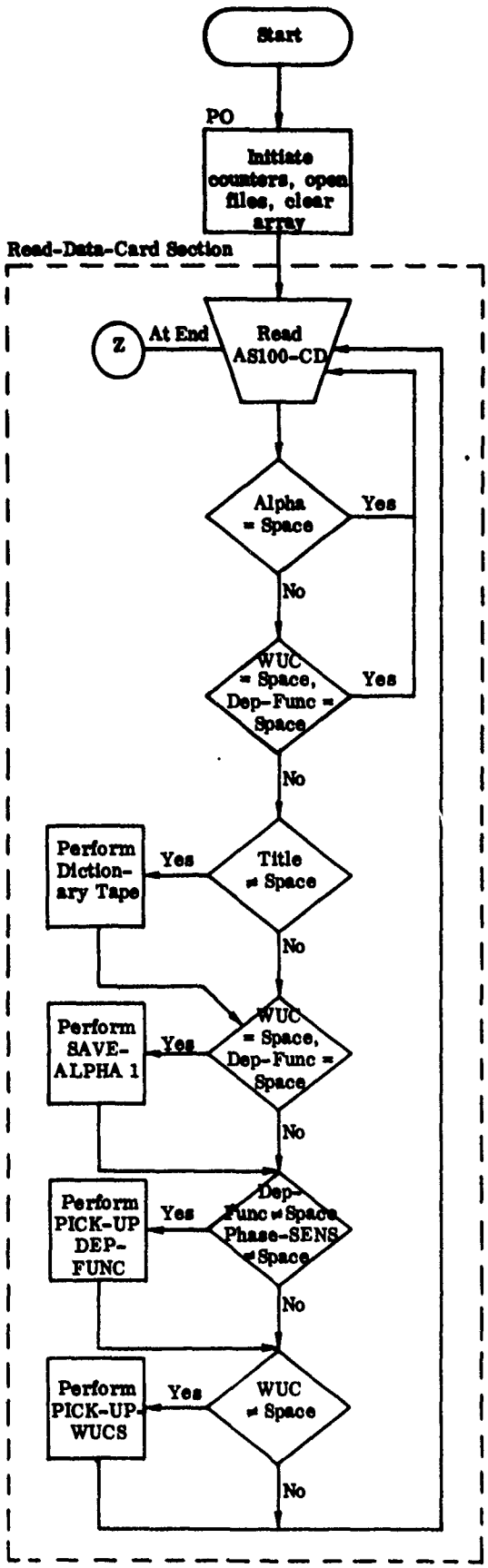
a. Input the aircraft function deck.

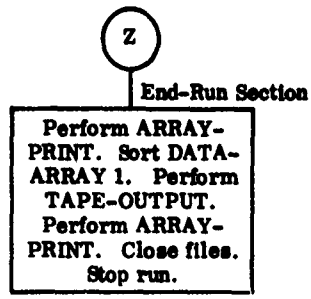
b. Generate AS100-T1 record for each alpha designator with Work Unit Code and title.

c. Generate AS100-T1 record for each function/dependent function relationship with appropriate Provisory Factors, sensitivities, etc.

Method: As the function deck is read, each function/dependent function relationship generates an array entry. In addition, each WUC encountered, treated as an input to the next function above it in the deck, creates an array entry. The array is then sorted and put out on AS100-T2. At the same time, alpha designators with their titles are outputted to AS100-T1.

PROGRAM AS100A (Functional Array Generator)





NOTE

If WUC is blank and DEP-FUNC is not blank, ALPHA-DISIG is saved since next card may be a WUC card for this ALPHA, and WUC cards do not indicate the ALPHA they refer to.

```
15154121   WWURC COB AS100A.AS100A
UCC COBOL TEST COMPILER
COMPILED ON -  31 JAN 7? AT 15154121
                1                       IDENTIFICATION DIVISION.
                2                       PROGRAM-ID.      AS100A.
                3                       AUTHOR. ROBT RITTER
                4                       REMARKS.         TOPDOWN FUNCTIONAL ARRAY GENERATOR.
                5                       ENVIRONMENT DIVISION.
                6                       CONFIGURATION SECTION.
                7                       SOURCE-COMPUTER. UNIVAC-1108.
                8                       OBJECT-COMPUTER. UNIVAC-1108.
                9                       INPUT-OUTPUT SECTION.
               10                       FILE-CONTROL.
               11                           SELECT FSORT ASSIGN TO DRUM 100000 WORDS.
               12                           SELECT AS100-T1
               13                                  ASSIGN TO  UNISERVO H.
               14                           SELECT AS100-T2
               15                                  ASSIGN TO  UNISERVO F.
               16                           SELECT AS100-R1
               17                                  ASSIGN TO  PRINTER.
               18                           SELECT AS100-CD
               19                                  ASSIGN TO  CARD-READER-EIGHTY.
               20                       DATA DIVISION.
               21                       FILE SECTION.
               22                       FD AS100-T1  LABEL RECORD OMITTED DATA RECORD DICT-ENTRY.
               23                       01 DICT-ENTRY.
               24                           02 DT-ALPHA PICTURE XXXXXX.
               25                1 0        02 DT-ADLR PICTURE X.
               26                1 1        02 DT-WUC PICTURE XXXXXXX.
               27                2 2        02 DT-TITLE PICTURE X(27).
               28                       FD AS100-R1 LABEL RECORD OMITTED DATA RECORD PRINT-LINE.
               29                       01 PRINT-LINE PICTURE X(132).
               30                       FD AS100-CD LABEL RECORD OMITTED DATA RECORDS ARE CARD1 CARD2.
               31                       01 CARD1.
               32                           02 FILLER PICTURE X(2).
               33                5 2        02 FLAG PICTURE X.
               34                5 3        02 TITLE PICTURE X(27).
               35                5 0        02 C31 PICTURE X.
               36                5 1        02 WUC PICTURE X(7).
               37                6 2        02 ADLR PICTURE X.
               38                6 3        02 ALPHA PICTURE X(6).
               39                7 3        02 C46 PICTURE X.
               40                7 4        02 CONFIG PICTURE XX.
               41                8 0        02 IFLR PICTURE X.
               42                8 1        02 INPUTS PICTURE X(6).
               43                9 1        02 DFLR PICTURE X.
               44                9 2        02 DEP-FUNCS PICTURE X(6).
               45               10 2        02 C63 PICTURE X.
               46               10 3        02 CON-FAC PICTURE XX.
               47               10 5        02 ALT-FUNC PICTURE XXXX.
               48               11 3        02 WUC-SENS PICTURE X.
               49               11 4        02 C71 PICTURE X.
               50               11 5        02 FLIGHT-PHASE-SENSITIVITY.
               51               11 5            03 SENS-PHN OCCURS 9 TIMES PICTURE X.
               52                       FD FSORT FILE CONTAINS ABOUT 4000 RECORDS DATA RECORD FSORT1.
               53                       01 FSORT1.
               54                           02 FS1 PICTURE X(14).
               55                6 2        02 FS-KEY PICTURE X(7).
               56                3 3        02 FS2 PICTURE X(16).
               57                6 1        02 FS3 PIC X.
               58                       FD AS100-T2  LABEL RECORD OMITTED DATA RECORD TAPE-REC.
               59                       01 TAPE-REC PICTURE X(2000).
               60                       WORKING-STORAGE SECTION.
               61                       77 DENTRY PICTURE 99999.
               62                1 0    77 DA-IND PICTURE 9(5).
               63                2 0    77 SAVE-ALPHA PICTURE X(6).
               64                3 0    77 SAVE-ADLR PICTURE X(6).
               65                4 0    01 DATA-ARRAY1.
               66                4 0           02 DA1 OCCURS 4000 TIMES.
               67                4 0              03 DALPHA.
               68                4 0                 04 DALPHA1 PICTURE X(6).
               69                5 0                 04 DALPHA2 PICTURE X.
               70                5 1              03 DWUC PICTURE XXXXXXX.
               71                6 2              03 DDEP-FUNC.
               72                6 2                 04 DDEP-FUNC1 PICTURE X(6).
               73                7 2                 04 DDEP-FUNC2 PICTURE X.
               74                7 3              03 DWUC-SENS PICTURE X.
               75                7 4              03 DPH-SENS PICTURE X(9).
               76                4 1              03 DK-FAC.
               77                9 1                 04 DK-FAC1 PICTURE X.
               78                9 2                 04 DK-FAC2 PICTURE X.
               79                9 3              03 DALT-FUNC PICTURE XXXX.
               80               10 1              03 DTYPE PIC X.
               81                4 0    01 DATA-ARRAY2 REDEFINES DATA-ARRAY1.
               82                4 0       02 DA2 OCCURS 76 TIMES PICTURE X(2000).
               83                4 0    PROCEDURE DIVISION.
               84                       PD.
               85                           OPEN INPUT AS100-CD.
               86                           OPEN OUTPUT AS100-R1.
               87                           OPEN OUTPUT AS100-T1.
               88                           MOVE 0 TO DENTRY.
               89                           MOVE 1 TO DA-IND.
               90                           PERFORM ARRAY-CLEAR VARYING TALLY FROM 1 BY 1 UNTIL TALLY
               91                               GREATER THAN 4000.
               92                           GO TO READ-DATA-CARDS.
               93                       READ-DATA-CARDS SECTION.
               94                       RDC1.
               95                           READ AS100-CD AT END GO TO END-RUN.
               96                           IF ALPHA EQUAL SPACE GO TO RDC1.
               97                           IF WUC EQUAL SPACE AND DEP-FUNCS EQUAL SPACE GO TO RDC1.
               98                           IF TITLE NOT EQUAL SPACE
               99                           PERFORM DICTIONARY-TAPE.
              100                           IF WUC EQUAL SPACE AND DEP-FUNCS NOT EQUAL SPACE
```

```
                    PERFORM SAVE-ALPHA1.
                IF DEP-FUNCS NOT EQUAL SPACE AND FLIGHT-PHASE-SENSITIVITY
                    NOT EQUAL SPACE PERFORM PICK-UP-DEP-FUNC.
                IF WUC NOT EQUAL SPACE PERFORM PICK-UP-WUCS.
                GO TO RDC1.
            SAVE-ALPHA1.
                MOVE ALPHA TO SAVE-ALPHA.
                MOVE ADLR TO SAVE-ADLR.
            PICK-UP-DEP-FUNC SECTION.
            PU1.
                MOVE ALPHA TO SAVE-ALPHA.
                MOVE ADLR TO SAVE-ADLR.
                MOVE ALPHA TO DALPHA1(DA-IND).
                MOVE ADLR TO DALPHA2(DA-IND).
                MOVE DEP-FUNCS TO DDEP-FUNC1(DA-IND).
                MOVE DFLR TO DDEP-FUNC2(DA-IND).
                MOVE CON-FAC TO DK-FAC(DA-IND).
                MOVE ALT-FUNC TO DALT-FUNC(DA-IND).
                MOVE FLIGHT-PHASE-SENSITIVITY TO DFH-SENS(DA-IND).
                MOVE C71 TO DTYPE(DA-IND).
                ADD 1 TO DA-IND.
            PICK-UP-WUCS SECTION.
            PW1.
                MOVE ALPHA TO DALPHA1(DA-IND).
                MOVE ADLR TO DALPHA2(DA-IND).
                MOVE SAVE-ALPHA TO  DDEP-FUNC1(DA-IND).
                MOVE SAVE-ADLR TO DDEP-FUNC2(DA-IND).
                MOVE WUC TO DWUC(DA-IND).
                MOVE WUC-SENS TO DWUC-SENS(DA-IND).
                IF WUC-SENS EQUAL ' ' MOVE 'A' TO DWUC-SENS(DA-IND).
                MOVE CON-FAC TO DK-FAC(DA-IND).
                MOVE C71 TO DTYPE(DA-IND).
                ADD 1 TO DA-IND.
            PW-EXIT.
                EXIT.
            END-RUN SECTION.
            ER1.
                SORT FSORT ON ASCENDING KEY FS-KEY INPUT PROCEDURE IS
                    FS-IN OUTPUT PROCEDURE IS FS-OUT.
                PERFORM TAPE-OUTPUT.
                PERFORM ARRAY-PRINT.
                CLOSE AS100-T1.
                MONITOR DENTRY.
                MONITOR DA-IND.
                STOP RUN.
            DICTIONARY-TAPE SECTION.
            DS1.
                MOVE ALPHA TO DT-ALPHA.
                MOVE ADLR TO DT-ADLR.
                MOVE WUC TO DT-WUC.
                MOVE TITLE TO DT-TITLE.
                WRITE DICT-ENTRY.
                ADD 1 TO DENTRY.
            DS-EXIT.
                EXIT.
            FS-IN SECTION.
            FS1.
                PERFORM FS2 VARYING TALLY FROM 1 BY 1 UNTIL TALLY
                    GREATER THAN 4000.
                GO TO FS1-EXIT.
            FS2.
                IF DALPHA(TALLY) NOT EQUAL SPACE RELEASE FSORT1
                    FROM DA1(TALLY).
            FS1-EXIT.
                EXIT.
            FS-OUT SECTION.
            FS3.
                PERFORM FS4 VARYING TALLY FROM 1 BY 1 UNTIL TALLY
                    GREATER THAN 4000.
            FS4.
                RETURN FSORT RECORD INTO DA1(TALLY) AT END GO TO FS3-EXIT.
            FS3-EXIT.
                EXIT.
            TAPE-OUTPUT SECTION.
            TO1.
                OPEN OUTPUT AS100-T2.
                PERFORM TO2 VARYING TALLY FROM 1 BY 1 UNTIL TALLY
                    GREATER THAN 70.
                CLOSE AS100-T2.
                GO TO TO-EXIT.
            TO2.
                WRITE TAPE-REC FROM DA2(TALLY).
            TO-EXIT.
                EXIT.
            ARRAY-PRINT SECTION.
            AR1.
                MONITOR DA-IND.
                PERFORM AR2 VARYING TALLY FROM 1 BY 1 UNTIL TALLY
                    GREATER THAN 4000.
                GO TO AR-EXIT.
            AR2.
                IF DALPHA(TALLY) EQUAL SPACE GO TO AR-EXIT.
                WRITE PRINT-LINE FROM DA1(TALLY).
            AR-EXIT.
                EXIT.
            MISC SECTION.
            ARRAY-CLEAR.
                MOVE SPACE TO DA1(TALLY).
```

CROSS REFERENCE LIST

```
0030                AS100-CD      0018  0030
0020                AS100-R1      0016  0006
0022                AS100-T1      0012  0022
0058                AS100-T2      0014  0054
0002                FSORT  0011   0052
0190                *ARRAY-CLEAR  OF    MISC    0092  0092  0092
0187                *ARRAY-PRINT  0181  0181    0181
0195                *AR-EXIT      OF    ARRAY   0190  0193  0196
0187                *AR1     OF   ARRAY
0192                *AR2     OF   ARRAY   0190  0190  0190
0168                *DICTIONARY-TAPE      0099  0099  0099
0196                *DS-EXIT      OF    DICT1   0198
0168                *DS1     OF   DICT1
0138                *END-RUN      0098
0138                *EH1     OF   END-R
0158                *FS-IN   0170  0139  0139
0168                *FS-OUT       0140  0140  0140
0198                *FS1     OF   FS-IN
0165                *FS1-EXIT     OF    FS-IN   0160  0166
0162                *FS2     OF   FS-IN   0160  0160  0160
0160                *FS3     OF   FS-OU
0173                *FS3-EXIT     OF    FS-OU   0171  0173
0171                *FS4     OF   FS-OU   0170  0170  0170
0190                *MISC
0111                *PICK-UP-DEP-FUNC     0103  0103  0103
0124                *PICK-UP-WUCS         0104  0104  0104
0004                *PO      OF   SBAAB
0111                *PU1     OF   PICK-
0135                *PU-EXIT      OF    PICK-   0135
0124                *PW1     OF   PICK-
0095                *RDC1    OF   READ-   0096  0097  0105
0095                *READ-DATA-CARDS      0092
0107                *SAVE-ALPHA1  OF    READ-   0101  0101  0101
0176                *TAPE-OUTPUT  0140  0140    0140
0144                *TO-EXIT      OF    TAPE-   0180  0184
0176                *TO1     OF   TAPE-
0182                *TO2     OF   TAPE-   0179  0179  0179
0037                ADLR     OF   CARD1   0108  0112  0114  0125  0149
0038                ALPHA    OF   CARD1   0096  0108  0112  0113  0124  0148
0047                ALT-FUNC      OF    CARD1   0118
0030                AS100-CD      0085  0095
0028                AS100-R1      0086
0022                AS100-T1      0087  0142
0058                AS100-T2      0176  0179
0031                CARD1    OF   AS100
0040                CONFIG        OF    CARD1
0046                CON-FAC       OF    CARD1   0117  0131
0035                C31      OF   CARD1
0039                C66      OF   CARD1
0045                C63      OF   CARD1
0049                C71      OF   CARD1   0120  0132
0067                DALPHA        OF    DA1     0142  0192
0068                DALPHA1       OF    DALPH   0113  0124
0069                DALPHA2       OF    DALPH   0114  0125
0079                DALT-FUNC     OF    DA1     0118
0065                DATA-ARRAY1   OF    WORK1
0061                DATA-ARRAY2   OF    WORK1
0062                DA-IND        OF    WORK1   0089  0113  0114  0116  0116  0118  0118  0119  0120  0121  0124
                     0125  0126  0128  0129  0129  0130  0132  0132  0133  0144  0187
0066                DA1      OF   DATA-  0163  0171  0193  0196
0082                DA2      OF   DATA-  0183
0071                DDEP-FUNC     OF    DA1
0072                DDEP-FUNC1    OF    DDEP-   0116  0126
0073                DDEP-FUNC2    OF    DDEP-   0116  0128
0061                DENTRY        OF    WORK1   0088  0143  0153
0044                DEP-FUNCS     OF    CARD1   0097  0101  0102  0115
0043                DFLR     OF   CARD1   0116
0023                DICT-ENTRY    OF    AS100   0152
0076                DK-FAC        OF    DA1     0118  0132
0077                DK-FAC1       OF    DK-FA
0078                DK-FAC2       OF    DK-FA
0075                DPH-SENS      OF    DA1     0119
0080                DTYPE    OF   DA1     0120  0132
0025                DT-ADLR       OF    DICT-   0149
0024                DT-ALPHA      OF    DICT-   0148
0027                DT-TITLE      OF    DICT-   0151
0026                DT-WUC        OF    DICT-   0151
0070                DWUC     OF   DA1     0129
0074                DWUC-SENS     OF    DA1     0129  0130
0033                FLAG     OF   CARD1
0050                FLIGHT-PHASE-SENSITIVITY      OF    CARD1   0103  0119
0052                FSORT  0138   0139   0140    0171  0171
0053                FSORT1        OF    FSORT   0163  0163
0055                FS-KEY        OF    FSORT   0138
0054                FS1      OF   FSORT
0056                FS2      OF   FSORT
0057                FS3      OF   FSORT
0041                IFLR     OF   CARD1
0042                INPUTS        OF    CARD1
0029                PRINT-LINE    OF    AS100   0193  0193
0064                SAVE-ADLR     OF    WORK1   0108  0112  0127
0063                SAVE-ALPHA    OF    WORK1   0108  0112  0126
0051                SENS-PHN      OF    FLIGH
                     0177  0179  0177  0183  0188  0190  0188  0192  0193  0196
0059                TAPE-REC      OF    AS100   0182  0183
0034                TITLE    OF   CARD1   0099  0151
0036                WUC      OF   CARD1   0097  0100  0104  0126  0151
0048                WUC-SENS      OF    CARD1   0129  0130

ERROR  0198   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0193   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0192   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0183   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0171   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0163   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0162   SIGN PRESENT ON FIELD SHOULD BE POSITIVE

COBOL COMPILATION TIME      4 SECONDS.
```

PROGRAM: AS101A

Inputs: AS100-T1

Output: AS100-T1
AS101-R1

Purpose: Sort, by alpha designator, the dictionary tape operated by AS100A.

```
10:26:02    SOUR .OB AS101A+AS101A
 UCC COBOL VERSION 3.0LA
COMPILED ON -  24 JAN 78 AT 10:26:02
          1                 IDENTIFICATION DIVISION.
          2                 PROGRAM-ID.     AS101A.
          3                 AUTHOR. ROBT RITTER
          4                 REMARKS.        SORT DICTIONARY TAPE.
          5                 ENVIRONMENT DIVISION.
          6                 CONFIGURATION SECTION.
          7                 SOURCE-COMPUTER. UNIVAC-1108.
          8                 OBJECT-COMPUTER. UNIVAC-1108.
          9                 INPUT-OUTPUT SECTION.
         10                 FILE-CONTROL.
         11                     SELECT AS100-T1 ASSIGN TO UNISERVO H.
         12                     SELECT AS101-R1 ASSIGN TO PRINTER.
         13                     SELECT FSORT ASSIGN TO DRUM 100000 WORDS.
         14                 DATA DIVISION.
         15                 FILE SECTION.
         16                 FD AS100-T1  LABEL RECORD OMITTED DATA RECORD DICT-ENTRY.
         17                 01 DICT-ENTRY.
         18                     02 DT-ALPHA PICTURE XXXXXX.
         19     1 0             02 DT-ADLR PICTURE X.
         20     1 1             02 DT-WUC PICTURE XXXXXX.
         21     1 2             02 DT-TITLE PICTURE X(27).
         22                 FD AS101-R1 LABEL RECORD OMITTED DATA RECORD PRINT-LINE.
         23                 01 PRINT-LINE PICTURE X(132).
         24                 SD FSORT FILE CONTAINS ABOUT 4080 RECORDS DATA RECORD IS FSORT1.
         25                 01 FSORT1.
         26                     02 FSKEY PICTURE XXXXXX.
         27     1 1             02 FSREST PICTURE X(34).
         28     1 1         WORKING-STORAGE SECTION.
         29                 01 PL1 PICTURE X(41).
         30                 PROCEDURE DIVISION.
         31                 P0.
         32                     OPEN OUTPUT AS101-R1.
         33                     SORT FSORT ON ASCENDING KEY FSKEY INPUT PROCEDURE IS F-IN
         34                         OUTPUT PROCEDURE IS F-OUT.
         35                     CLOSE AS101-R1.
         36                     CLOSE AS100-T1.
         37                     STOP RUN.
         38                 F-IN SECTION.
         39                 F1.
         40                     OPEN INPUT AS100-T1.
         41                 F2.
         42                     READ AS100-T1 AT END GO TO F1-EXIT.
         43                     RELEASE FSORT1 FROM DICT-ENTRY.
         44                     GO TO F2.
         45                 F1-EXIT.
         46                     EXIT.
         47                 F-OUT SECTION.
         48                 F3.
         49                     CLOSE AS100-T1.   OPEN OUTPUT AS100-T1.
         50                 F4.
         51                     RETURN FSORT RECORD INTO DICT-ENTRY AT END GO TO F3-EXIT.
         52                     MOVE DICT-ENTRY TO PL1.
         53                     WRITE DICT-ENTRY.
         54                     WRITE PRINT-LINE FROM PL1.
         55                     GO TO F4.
         56                 F3-EXIT.
         57                     EXIT.
```

C R O S S R E F E R E N C E L I S T

```
0016                AS100-T1     0011  0016
0022                AS101-R1     0012  0022
0024                FSORT  0013  0024
0040               *F-IN   0034  0034  0034
0049               *F-OUT  0034  0034  0034
0040               *F1     OF    F-IN
0046               *F1-EXIT     OF    F-IN   0042  0046
0042               *F2     OF    F-IN   0044
0049               *F3     OF    F-OUT
0057               *F3-EXIT     OF    F-OUT  0051  0057
0051               *F4     OF    F-OUT  0055
0031               *P0     OF    $SAAB
0016                AS100-T1     0036  0040  0042  0049  0049
0022                AS101-R1     0032  0035
0017                DICT-ENTRY   OF    AS100  0044  0051  0052  0053
0019                DT-ADLR      OF    DICT-
0018                DT-ALPHA     OF    DICT-
0021                DT-TITLE     OF    DICT-
0020                DT-WUC       OF    DICT-
0026                FSKEY  OF    FSORT  0033
0024                FSORT  0031        0034  0051  0051
0025                FSORT1       OF    FSORT  0043  0044
0027                FSREST       OF    FSORT
0029                PL1    OF    WORKI  0052  0054
0023                PRINT-LINE   OF    AS101  0054  0054
```

COBOL COMPILATION TIME 2 SECONDS.

PROGRAM: AS200A

Inputs: AS100-T2 (Array tape)
AS200-CD (Control card, starter deck)

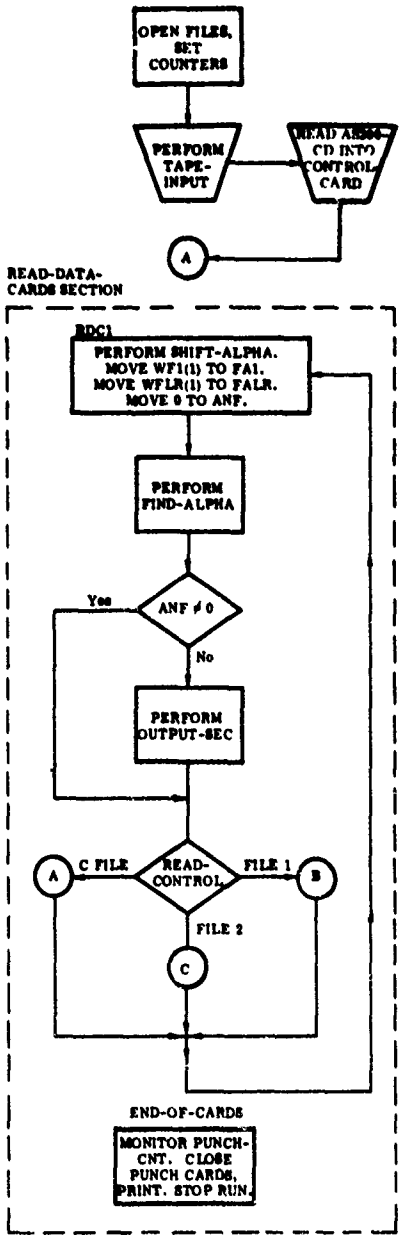
Outputs: AS200-T1 (Path/sensitivity tape)
AS200-R1 (Exception report)

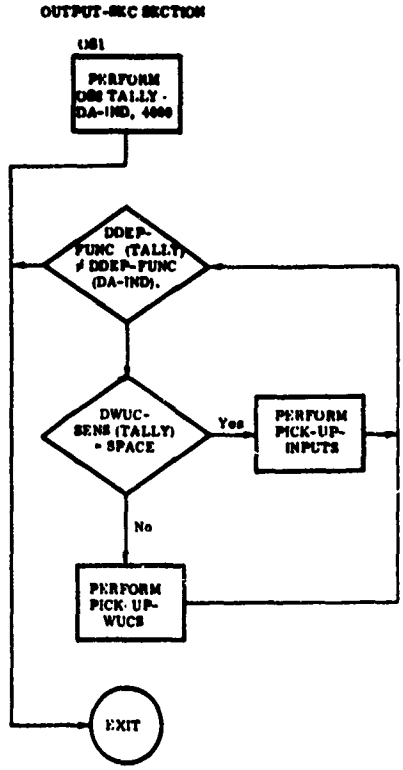
Drum Files: AS200-D1
AS200-D2

Purpose: Generate the path/sensitivity tape (AS200-T1) from the array tape (AS100-T2) and starter deck (AS200-CD), printing an exception report of paths in loops and multiple "K" paths as they are encountered.

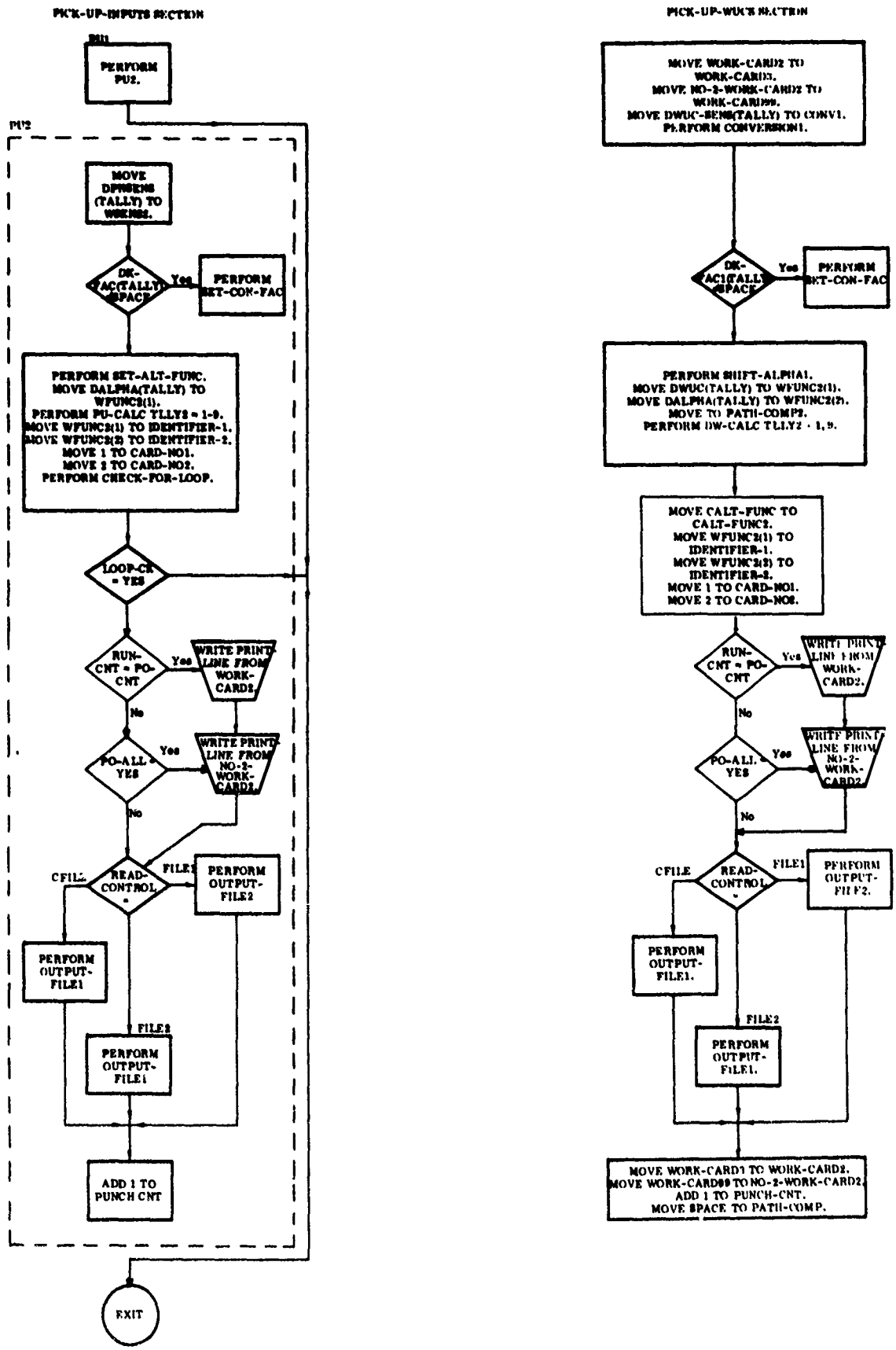
Method: The array-tape (AS100-T2) gives all the function/dependent function relationships in the aircraft. Starting at some point, say function AB (determined by starter deck), all functions listing AB as dependent function are found, e.g., ABA, ABB, ABC. Each of these creates a path record (ABA-AB, ABB-AB, ABC-AB) which is written on AS200-D1. This is done for each function in the starter deck. When the starter deck is exhausted, AS200-D1 becomes a "starter deck" and the process is repeated with results going to AS200-D2. This alternating is continued between D1-D2 until all paths end or a set number of iterations are made. As indicated above, AS200-T1 is a path/sensivity tape determined by the control card read at the start of the program. If the run is a sensitivity computation run, paths are dropped upon encountering "F" dependent-functions. A function-path run drops paths upon encountering an "S" dependent function.

AS200A TOP-DOWN PATH GENERATOR

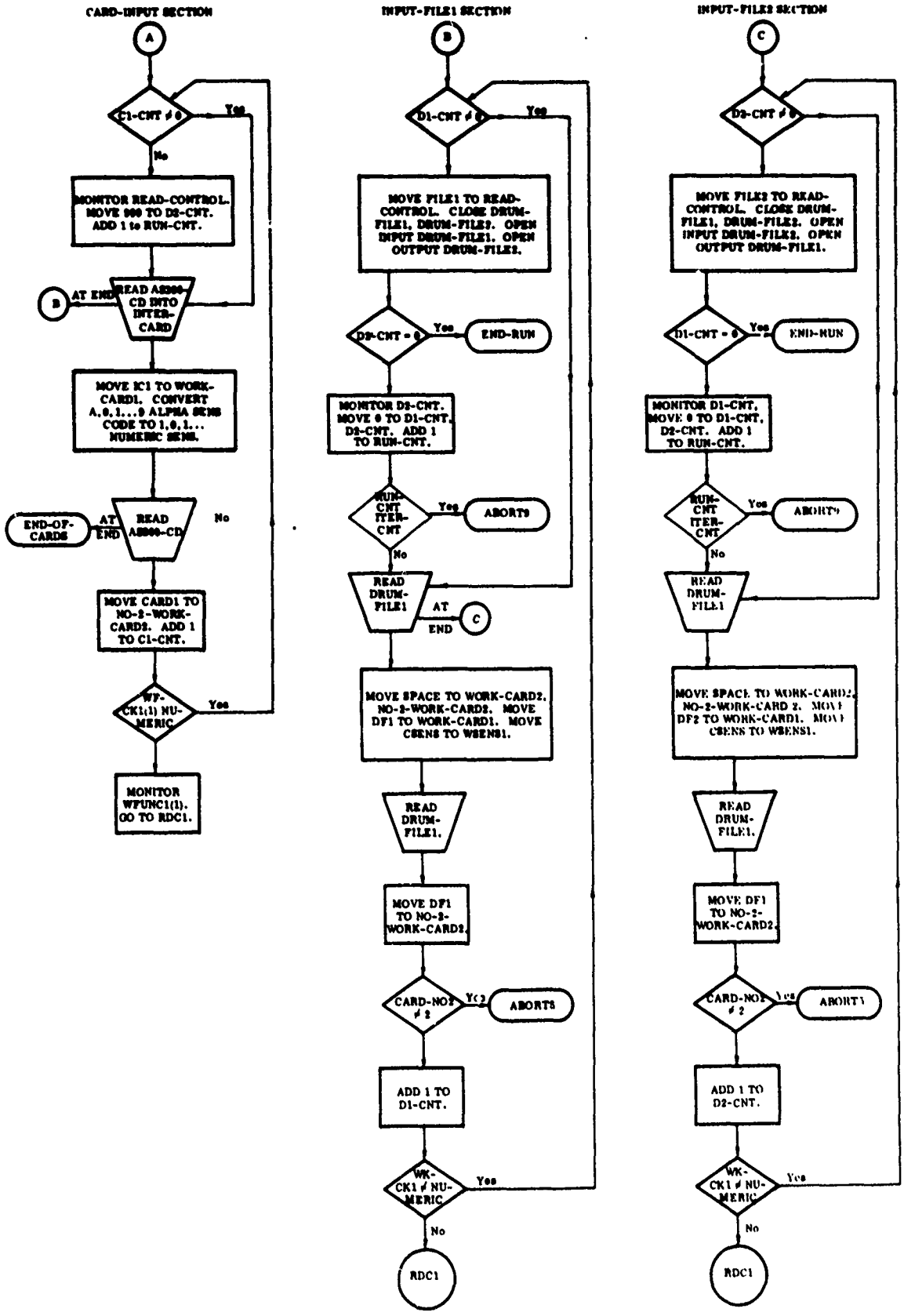




AS200A TOP-DOWN PATH GENERATOR



AS200A TOP-DOWN PATH GENERATOR



```
12:06:53    QBUR COR AS200A,AS200A
COBOL UCC VERSION 3
COMPILED ON -  21 DEC 69 AT 12:06:53
            1                       IDENTIFICATION DIVISION.
            2                       PROGRAM-ID.     AS200A.
            3                       AUTHOR. ROBT RITTER
            4                       REMARKS.        FUNCTIOANAL AND SENSITIVITY PATH GEN.
            5                       ENVIRONMENT DIVISION.
            6                       CONFIGURATION SECTION.
            7                       SOURCE-COMPUTER. UNIVAC-1108.
            8                       OBJECT-COMPUTER. UNIVAC-1108.
            9                       INPUT-OUTPUT SECTION.
           10                       FILE-CONTROL.
           11                           SELECT AS200-T1 ASSIGN TO UNISERVO A
           12                               RESERVE 2 ALTERNATE AREAS.
           13                           SELECT AS100-T2 ASSIGN TO UNISERVO F.
           14                           SELECT AS200-CD ASSIGN TO CARD-READER-EIGHTY.
           15                           SELECT AS200-R1 ASSIGN TO PRINTER.
           16                           SELECT DRUM-FILE1 ASSIGN TO DRUM 700000 WORDS.
           17                           SELECT DRUM-FILE2 ASSIGN TO DRUM 700000 WORDS.
           18                       DATA DIVISION.
           19                       FILE SECTION.
           20                       FD AS200-T1  LABEL RECORD OMITTED DATA RECORD TR1
           21                            BLOCK CONTAINS 40 RECORDS.
           22                       01 TR1.
           23                           02 TR11 PICTURE X(78).
           24     13 0                  02 TR12 PICTURE XX.
           25     13 2                  02 TR13 PIC X(28).
           26                       FD AS200-R1 LABEL RECORD OMITTED DATA RECORD PRINT-LINE.
           27                       01 PRINT-LINE PICTURE X(132).
           28                       FD DRUM-FILE1 LABEL RECORD OMITTED DATA RECORD DF1
           29                           BLOCK CONTAINS 40 RECORDS.
           30                       01 DF1 PICTURE X(108).
           31                       FD DRUM-FILE2 LABEL RECORD OMITTED DATA RECORD DF2
           32                           BLOCK CONTAINS 40 RECORDS.
           33                       01 DF2 PICTURE X(108).
           34                       FD AS100-T2  LABEL RECORD OMITTED DATA RECORD TAPE-REC.
           35                       01 TAPE-REC PICTURE X(2000).
           36                       FD AS200-CD LABEL RECORD OMITTED DATA RECORD IS CARD1.
           37                       01 CARD1 PICTURE X(80).
           38                       WORKING-STORAGE SECTION.
           39                       77  SAF-F1  PIC X.
           40      1 0              77  SAF-F2  PIC X.
           41      2 0              77 READ-CONTROL PICTURE XXXXX VALUE 'CFILE'.
           42      3 0              77 PATH-CNT     PICTURE 9(5) VALUE 0.
           43      4 0              77 RUN-CNT      PICTURE 9(5) VALUE 0.
           44      5 0              77 D1-CNT       PICTURE 9(5) VALUE 0.
           45      6 0              77 D2-CNT       PICTURE 9(5) VALUE 0.
           46      7 0              77 WUC-CNT      PICTURE 9(5) VALUE 0.
           47      8 0              77 C1-CNT       PICTURE 9(5) VALUE 0.
           48      9 0                  77 TLLY2 PICTURE 99999.
           49     10 0              77 DA-IND PICTURE 99999.
           50     11 0              77 TLLY1 PICTURE 99999.
           51     12 0              77 FALR PICTURE X.
           52     13 0              77 CONV1 PICTURE X.
           53     14 0              77 CONV2 PICTURE X.
           54     15 0              77 CONV3 PICTURE 9V99.
           55     16 0              77 Z PICTURE 99999.
           56     17 0              77 FA1       PICTURE X(6).
           57     18 0              77 FA2 PICTURE X.
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 58    19 0          77 LOOP-CK PICTURE XXX.
 59    20 0          77 PUNCH-CNT PICTURE 99999.
 60    21 0          77 TLY PICTURE 99999.
 61    22 0          77 ZZZ PICTURE 99999.
 62    23 0          77 ANF PICTURE 99999.
 63    24 0          77 Y PICTURE 99999.
 64    25 0          77 X PICTURE 99999.
 65    26 0          77 ZZ PICTURE 99999.
 66    27 0          77 R PICTURE 9V9.
 67    28 0          77 RR PICTURE 9V9.
 68    29 0          77 RRR PICTURE 9V9.
 69    30 0          77 MA-IND PICTURE 99999.
 70    31 0          01 INTER-CARD.
 71    31 0              02 IC1 PIC X(68).
 72    42 2              02 IC2 PIC X OCCURS 9 TIMES.
 73    42 2              02 IC21 REDEFINES IC2.
 74    42 2                  03  IC3 PIC V9 OCCURS 9 TIMES.
 75    43 5              02 IC4 PIC X.
 76    44 0              02 IC5 PIC 99.
 77    45 0          01 INT-C1.
 78    45 0              02 WSENS1.
 79    45 0              03 WSENS  PIC 9V999 OCCURS 9 TIMES.
 80    51 0          01  CONTROL-CARD.
 81    51 0              02  TYPE-RUN          PIC X.
 82    51 1              02  FILLER            PIC X.
 83    51 2              02  ITER-CNT          PIC 99.
 84    51 4              02  FILLER            PIC X.
 85    51 5              02  PO-CNT            PIC 99.
 86    52 1              02  FILLER            PIC X.
 87    52 2              02  PO-ALL            PIC XXX.
 88    52 5              02  FILLER            PIC X(69).
 89    65 0          01 DATA-ARRAY1.
 90    65 0                  02 DA1 OCCURS 4000 TIMES.
 91    65 0                  03 DALPHA.
 92    65 0                  04 DALPHA1 PICTURE X(6).
 93    66 0                  04 DALPHA2 PICTURE X.
 94    66 1              03 DWUC PICTURE X(7).
 95    67 2                  03 DDEP-FUNC.
 96    67 2                  04 DDEP-FUNC1 PICTURE X(6).
 97    68 2                  04 DDEP-FUNC2 PICTURE X.
 98    68 3                  03 DWUC-SENS PICTURE X.
 99    68 4                  03 DPH-SENS PICTURE X(9).
100    70 1                  03 DK-FAC.
101    70 1                  04 DK-FAC1 PICTURE X.
102    70 2                  04 DK-FAC2 PICTURE X.
103    70 3                  03 DALT-FUNC PICTURE XXXX.
104    71 1                  03 DTYPE  PIC X.
105    65 0          01 DATA-ARRAY2 REDEFINES DATA-ARRAY1.
106    65 0              02 DA2 OCCURS 76 TIMES PICTURE X(2000).
107  5399 0          01 WORK-CARD1.
108  5399 0              02 WFUNC1 OCCURS 8 TIMES.
109  5399 0                  03 WF1.
110  5399 0                  04 WF-CK1 PICTURE X.
111  5399 1                  04 WF11 PICTURE XXXXX.
112  5400 0                  03 WFLR PICTURE X.
113  5408 2              02 EXTRA-SPACE PICTURE X.
114  5408 3              02 CALT-FUNC PICTURE XXXXXX.
115  5409 3              02 CALT-LR PICTURE X.
116  5409 4              02 CCFC1.
117  5409 4              03 CCON-FAC OCCURS 4 TIMES PICTURE X.
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118  5410 2              02 CSENS PIC X(36).
119  5416 2              02 PATH-COMP PICTURE X.
120  5416 3              02 CARD-NO PIC 99.
121  5416 5              02 FILLER PIC X.
122  5417 0          01 WORK-CARD2.
123  5417 0              02 WFUNC2 OCCURS 8 TIMES.
124  5417 0                  03 WF2.
125  5417 0                  04 WF-CK2 PICTURE X.
126  5417 1                  04 WF21 PICTURE XXXXX.
127  5418 0                  03 WFLR2 PICTURE X.
128  5426 2              02 EXTRA-SPACE2 PICTURE X.
129  5426 3              02 CALT-FUNC2 PICTURE XXXXXX.
130  5427 3              02 CALT-LR2 PICTURE X.
131  5427 4              02 CCFC2.
132  5427 4              03 CCON-FAC2 OCCURS 4 TIMES PICTURE X.
133  5428 2              02 CSENS2 OCCURS 9 TIMES PIC 9V999.
134  5434 2              02 PATH-COMP2 PICTURE X.
135  5434 3              02 CARD-NO1 PICTURE 99.
136  5434 5              02 FILLER PIC X.
137  5435 0          01 NO-2-WORK-CARD2.
138  5435 0              02 IDENTIFIER-1 PICTURE X(7).
139  5436 1              02 IDENTIFIER-2 PICTURE X(7).
140  5437 2              02 ADDITIONAL-PATH-DATA.
141  5437 2                  03 APD PICTURE X(7) OCCURS 9 TIMES.
142  5447 5              02 FILLER PICTURE X.
143  5448 0              02 CARD-NO2 PICTURE 99.
144  5448 2              02 FILLER PIC X(28).
145  5453 0          01 WORK-CARD99 PIC X(108).
146  5471 0          01 WORK-CARD3  PIC X(108).
147  5489 0          01 WSENS2.
148  5489 0              02 WS2 OCCURS 9 TIMES PICTURE X.
149  5491 0          01 LOOP-LINE PICTURE X(36) VALUE
150  5491 0              '    ****THE NEXT ENTRY IS IN A LOOP'.
151  5497 0          01  DIAG-1 PIC X(132) VALUE
152  5497 0              '    ****SECOND ALTERNATE FUNCTION ENCOUNTERED'.
153  5497 0
154  5497 0
155  5497 0
156  5497 0
157  5497 0
158  5497 0
159                  PROCEDURE DIVISION.
160                  P0.
161                      OPEN INPUT AS200-CD.
162                      OPEN OUTPUT AS200-R1.
163                      OPEN OUTPUT AS200-T1.
164                      OPEN OUTPUT DRUM-FILE1, DRUM-FILE2.
165                      PERFORM TAPE-INPUT.
166                      MOVE 0 TO PUNCH-CNT.
167                      READ AS200-CD INTO CONTROL-CARD AT END STOP RUN.
168                      GO TO CARD-INPUT.
169                  READ-DATA-CARDS SECTION.
170                  RDC1.
171                      PERFORM SHIFT-ALPHA.
172                      MOVE WF1(1) TO FA1.
173                      MOVE WFLR(1) TO FALR.
174                      MOVE 0 TO ANF.
175                      PERFORM FIND-ALPHA.
176                      IF ANF GREATER THAN 0 GO TO RDC11.
177                      PERFORM OUTPUT-SEC.
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178                 RDC11.
179                     IF READ-CONTROL EQUAL 'CFILE' GO TO CARD-INPUT.
180                     IF READ-CONTROL EQUAL 'FILE1' GO TO INPUT-FILE1.
181                     IF READ-CONTROL EQUAL 'FILE2' GO TO INPUT-FILE2.
182                 END-OF-CARDS.
183                     MONITOR PUNCH-CNT.
184                     CLOSE AS200-CD, AS200-R1.
185                     STOP RUN.
186
187
188
189
190
191                 OUTPUT-SEC SECTION.
192                 OS1.
193                     PERFORM OS2 VARYING TALLY FROM DA-IND BY 1 UNTIL TALLY
194                         GREATER THAN 4000.
195                     GO TO OS-EXIT.
196                 OS2.
197                     IF      DDEP-FUNC(TALLY) NOT EQUAL DDEP-FUNC(DA-IND)
198                             GO TO OS-EXIT.
199                     IF DWUC-SENS(TALLY) EQUAL SPACE PERFORM PICK-UP-INPUTS
200                         ELSE PERFORM PICK-UP-WUCS.
201                 OS-EXIT.
202                     EXIT.
203
204
205
206
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208
209                 FIND-ALPHA SECTION.
210                 FF1.
211                     MOVE 0 TO ZZZ.
212                     PERFORM FF5 VARYING TLY FROM 100 BY 100 UNTIL ZZZ
213                         GREATER THAN 0.
214                     IF TLY EQUAL 200 MOVE 201 TO TLY.
215                     SUBTRACT 200 FROM TLY GIVING X. MOVE 0 TO Y, ZZZ.
216                     PERFORM FF6 VARYING TLY FROM X BY 10 UNTIL ZZZ
217                         GREATER THAN 0.
218                     IF TLY LESS THAN 21 MOVE 21 TO TLY.
219                     SUBTRACT 20 FROM TLY GIVING X. MOVE 0 TO Y, ZZZ.
220                     PERFORM FF7 VARYING TLY FROM X BY 1 UNTIL ZZZ EQUAL 999.
221                     SUBTRACT 1 FROM TLY.
222                 FF11.
223                     MOVE TLY TO DA-IND.
224                     GO TO FF-EXIT.
225                 FF5.
226                     IF TLY GREATER THAN 4000 PERFORM ALPHA-NOT-FOUND.
227                     IF ANF GREATER THAN 0 GO TO FF-EXIT.
228                     IF DDEP-FUNC1(TLY) EQUAL FA1 AND DDEP-FUNC2(TLY) EQUAL FALR
229                         MOVE 999 TO ZZZ.
230                     IF DDEP-FUNC1(TLY) GREATER THAN FA1 MOVE 999 TO ZZZ.
231                     IF DDEP-FUNC1(TLY) EQUAL FA1 AND DDEP-FUNC2(TLY) GREATER THAN
232                         FALR MOVE 999 TO ZZZ.
233                     IF DDEP-FUNC1(TLY) EQUAL SPACE MOVE 999 TO ZZZ.
234                 FF6.
235                     IF DDEP-FUNC1(TLY) EQUAL FA1 AND DDEP-FUNC2(TLY) EQUAL FALR
236                         MOVE 999 TO ZZZ.
237                     IF DDEP-FUNC1(TLY) GREATER THAN FA1 MOVE 999 TO ZZZ.
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238                 IF DDEP-FUNC1(TLY) EQUAL FA1 AND DDEP-FUNC2(TLY) GREATER THAN
239                     FALR MOVE 999 TO ZZZ.
240                 IF DDEP-FUNC(TLY) EQUAL SPACE MOVE 999 TO ZZZ.
241                 ADD 1 TO Y.
242                 IF Y GREATER THAN 11 GO TO ALPHA-NOT-FOUND.
243                 IF ANF GREATER THAN 0 GO TO FF-EXIT.
244             FF7.
245                 IF DDEP-FUNC1(TLY) EQUAL FA1 AND DDEP-FUNC2(TLY) EQUAL FALR
246                     MOVE 999 TO ZZZ.
247                 ADD 1 TO Y.
248                 IF Y GREATER THAN 11 GO TO ALPHA-NOT-FOUND.
249                 IF ANF GREATER THAN 0 GO TO FF-EXIT.
250             FF-EXIT.
251                 EXIT.
252
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258             PICK-UP-INPUTS SECTION.
259             PU1.
260                 IF      DTYPE (TALLY) NOT EQUAL ' ' AND
261                         DTYPE (TALLY) NOT EQUAL TYPE-RUN
262                         GO TO PU-EXIT.
263                 PERFORM PU2.
264                 GO TO PU-EXIT.
265             PU2.
266                 MOVE DPH-SENS(TALLY) TO WSENS2.
267                 MOVE CCFC1 TO CCFC2.
268                 IF DK-FAC1(TALLY) NOT EQUAL SPACE PERFORM SET-CON-FAC
269                         THRU SET-CON-FAC1.
270                 PERFORM SET-ALT-FUNC.
271                 MOVE DALPHA(TALLY) TO WFUNC2(1).
272                 PERFORM PU-CALC VARYING TLLY2 FROM 1 BY 1 UNTIL TLLY2
273                     GREATER THAN 9.
274                 MOVE WFUNC2(1) TO IDENTIFIER-1.
275                 MOVE WFUNC2(2) TO IDENTIFIER-2.
276                 MOVE 1 TO CARD-NO1.
277                 MOVE 2 TO CARD-NO2.
278                 PERFORM CHECK-FOR-LOOP.
279                 IF LOOP-CK EQUAL 'YES' GO TO PU-EXIT.
280                 IF RUN-CNT EQUAL PO-CNT PERFORM FINAL-OUTPUT.
281                 IF PO-ALL EQUAL 'YES' PERFORM  FINAL-OUTPUT.
282                 IF READ-CONTROL EQUAL 'CFILE' PERFORM OUTPUT-FILE1.
283                 IF READ-CONTROL EQUAL 'FILE1' PERFORM OUTPUT-FILE2.
284                 IF READ-CONTROL EQUAL 'FILE2' PERFORM OUTPUT-FILE1.
285                 ADD 1 TO ZZZ, PUNCH-CNT.
286             CHECK-FOR-LOOP.
287                 MOVE SPACE TO LOOP-CK.
288                 IF IDENTIFIER-1 EQUAL WFUNC2(2) MOVE  'YES' TO LOOP-CK.
289                 IF IDENTIFIER-1 EQUAL WFUNC2(3) MOVE  'YES' TO LOOP-CK.
290                 IF IDENTIFIER-1 EQUAL WFUNC2(4) MOVE  'YES' TO LOOP-CK.
291                 IF IDENTIFIER-1 EQUAL WFUNC2(5) MOVE  'YES' TO LOOP-CK.
292                 IF IDENTIFIER-1 EQUAL WFUNC2(6) MOVE  'YES' TO LOOP-CK.
293                 IF IDENTIFIER-1 EQUAL WFUNC2(7) MOVE  'YES' TO LOOP-CK.
294                 IF IDENTIFIER-1 EQUAL WFUNC2(8) MOVE  'YES' TO LOOP-CK.
295                 IF IDENTIFIER-1 EQUAL  APD(3)   MOVE  'YES' TO LOOP-CK.
296                 IF IDENTIFIER-1 EQUAL  APD(4)   MOVE  'YES' TO LOOP-CK.
297                 IF IDENTIFIER-1 EQUAL  APD(5)   MOVE  'YES' TO LOOP-CK.
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298                 IF IDENTIFIER-1 EQUAL  APD(6)   MOVE  'YES' TO LOOP-CK.
299                 IF IDENTIFIER-1 EQUAL  APD(7)   MOVE  'YES' TO LOOP-CK.
300                 IF IDENTIFIER-1 EQUAL  APD(8)   MOVE  'YES' TO LOOP-CK.
301                 IF IDENTIFIER-1 EQUAL  APD(9)   MOVE  'YES' TO LOOP-CK.
302                 IF LOOP-CK EQUAL 'YES' WRITE PRINT-LINE FROM LOOP-LINE.
303                 IF LOOP-CK EQUAL 'YES'
304                 WRITE PRINT-LINE FROM WORK-CARD2.
305                 IF LOOP-CK EQUAL 'YES'
306                 WRITE PRINT-LINE FROM NO-2-WORK-CARD2.
307             ALT-MESSAGE.
308                 WRITE PRINT-LINE FROM DIAG-1.
309                 WRITE PRINT-LINE FROM WORK-CARD1.
310                 WRITE PRINT-LINE FROM NO-2-WORK-CARD2.
311                GO TO PU-EXIT.
312             PU-DUMBY.
313                 MONITOR Y.
314             PU-EXIT.
315                 EXIT.
316
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322             PICK-UP-WUCS SECTION.
323             PW1.
324                 MOVE CCFC1 TO CCFC2.
325                 MOVE WORK-CARD2 TO WORK-CARD3.
326                 MOVE NO-2-WORK-CARD2 TO WORK-CARD99.
327                 MOVE  DWUC-SENS(TALLY) TO CONV2.
328                 PERFORM CONVERSION1.
329                 PERFORM SHIFT-ALPHA1.
330                 MOVE DWUC(TALLY) TO WFUNC2(1).
331                 MOVE DALPHA(TALLY) TO WFUNC2(2).
332                 MOVE    CALT-FUNC TO CALT-FUNC2.
333                 MOVE '*' TO PATH-COMP2.
334                 PERFORM PW-CALC VARYING TLLY2 FROM 1 BY 1 UNTIL TLLY2
335                     GREATER THAN 9.
336                 MOVE WFUNC2(1) TO IDENTIFIER-1.
337                 MOVE WFUNC2(2) TO IDENTIFIER-2.
338                 MOVE 1 TO CARD-NO1.
339                 MOVE 2 TO CARD-NO2.
340                 IF RUN-CNT EQUAL PO-CNT PERFORM FINAL-OUTPUT.
341                 IF PO-ALL EQUAL 'YES' PERFORM  FINAL-OUTPUT.
342                 IF READ-CONTROL EQUAL 'CFILE' PERFORM OUTPUT-FILE1.
343                 IF READ-CONTROL EQUAL 'FILE1' PERFORM OUTPUT-FILE2.
344                 IF READ-CONTROL EQUAL 'FILE2' PERFORM OUTPUT-FILE1.
345                 MOVE WORK-CARD3 TO WORK-CARD2.
346                 MOVE WORK-CARD99 TO NO-2-WORK-CARD2.
347                 ADD 1 TO PUNCH-CNT.
348                 MOVE SPACE TO PATH-COMP2.
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358                 TAPE-INPUT SECTION.
359                 TI1.
360                     OPEN INPUT AS100-T2.
361                     PERFORM TI2 VARYING TALLY FROM 1 BY 1 UNTIL
362                         TALLY GREATER THAN 74.
363                     CLOSE AS100-T2.
364                     GO TO TI-EXIT.
365                 TI2.
366                     READ AS100-T2 AT END GO TO TI-EXIT.
367                     MOVE TAPE-REC TO DA2(TALLY).
368                 TI-EXIT.
369                     EXIT.
370
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376                 CARD-INPUT SECTION.
377                 CS1.
378                     IF C1-CNT NOT EQUAL 0 GO TO CS2.
379                     MONITOR READ-CONTROL.
380                     MOVE 999 TO D2-CNT.
381                     ADD 1 TO RUN-CNT.
382                 CS2.
383                     READ    AS200-CD INTO INTER-CARD AT END GO TO INPUT-FILE1.
384                     MOVE SPACE TO WORK-CARD2.
385                     MOVE SPACE TO NO-2-WORK-CARD2.
386                     MOVE IC1 TO WORK-CARD1.
387                     IF IC2(1) = 'A' MOVE 1 TO WSENS(1) ELSE MOVE  IC3(1) TO
388                             WSENS(1).
389                     IF IC2(2) = 'A' MOVE 1 TO WSENS(2) ELSE MOVE  IC3(2) TO
390                             WSENS(2).
391                     IF IC2(3) = 'A' MOVE 1 TO WSENS(3) ELSE MOVE  IC3(3) TO
392                             WSENS(3).
393                     IF IC2(4) = 'A' MOVE 1 TO WSENS(4) ELSE MOVE  IC3(4) TO
394                             WSENS(4).
395                     IF IC2(5) = 'A' MOVE 1 TO WSENS(5) ELSE MOVE  IC3(5) TO
396                             WSENS(5).
397                     IF IC2(6) = 'A' MOVE 1 TO WSENS(6) ELSE MOVE  IC3(6) TO
398                             WSENS(6).
399                     IF IC2(7) = 'A' MOVE 1 TO WSENS(7) ELSE MOVE  IC3(7) TO
400                             WSENS(7).
401                     IF IC2(8) = 'A' MOVE 1 TO WSENS(8) ELSE MOVE  IC3(8) TO
402                             WSENS(8).
403                     IF IC2(9) = 'A' MOVE 1 TO WSENS(9) ELSE MOVE  IC3(9) TO
404                             WSENS(9).
405                     MOVE IC4 TO PATH-COMP.
406                     MOVE IC5 TO CARD-NO.
407                     MOVE INT-C1 TO CSENS.
408                     MOVE SPACE TO CCFC2.
409                     READ    AS200-CD AT END GO TO END-OF-CARDS.
410                     MOVE CARD1 TO  NO-2-WORK-CARD2.
411                     ADD 1 TO C1-CNT.
412                     IF WF-CK1(1) NUMERIC GO TO   CARD-INPUT.
413                 CS-EXIT.
414                     MONITOR WFUNC1(1).
415                     GO TO RDC1.
416                 INPUT-FILE1 SECTION.
417                 IF11.
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418                 IF D1-CNT NOT EQUAL 0 GO TO IF12.
419                 MOVE 'FILE1' TO READ-CONTROL.
420                 MONITOR READ-CONTROL.
421                 CLOSE DRUM-FILE1, DRUM-FILE2.
422                 OPEN INPUT DRUM-FILE1. OPEN OUTPUT DRUM-FILE2.
423                 IF D2-CNT EQUAL 0 GO TO END-RUN.
424                 MONITOR D2-CNT.
425                 MOVE 0 TO D1-CNT, D2-CNT.
426                 ADD 1 TO RUN-CNT.
427                 IF RUN-CNT GREATER THAN ITER-CNT GO TO ABORT9.
428             IF12.
429                 READ DRUM-FILE1 AT END GO TO INPUT-FILE2.
430                 MOVE SPACE TO WORK-CARD2, NO-2-WORK-CARD2.
431                 MOVE DF1 TO WORK-CARD1.
432                 MOVE CCFC1 TO CCFC2.
433                 MOVE CSENS TO WSENS1.
434                 READ DRUM-FILE1 AT END GO TO INPUT-FILE2.
435                 MOVE DF1 TO NO-2-WORK-CARD2.
436                 IF CARD-NO2 NOT EQUAL 2 GO TO ABORT5.
437                 ADD 1 TO D1-CNT.
438                 IF WF-CK1(1) NUMERIC GO TO  INPUT-FILE1.
439             IF1-EXIT.
440                 GO TO RDC1.
441             INPUT-FILE2 SECTION.
442             IF21.
443                 IF D2-CNT NOT EQUAL 0 GO TO IF22.
444                 MOVE 'FILE2' TO READ-CONTROL.
445                 MONITOR READ-CONTROL.
446                 CLOSE DRUM-FILE1, DRUM-FILE2.
447                 OPEN INPUT DRUM-FILE2. OPEN OUTPUT DRUM-FILE1.
448                 IF D1-CNT EQUAL 0 GO TO END-RUN.
449                 MONITOR D1-CNT.
450                 MOVE 0 TO D1-CNT, D2-CNT.
451                 ADD 1 TO RUN-CNT.
452                 IF RUN-CNT GREATER THAN ITER-CNT GO TO ABORT9.
453             IF22.
454                 READ DRUM-FILE2 AT END GO TO INPUT-FILE1.
455                 MOVE SPACE TO WORK-CARD2, NO-2-WORK-CARD2.
456                 MOVE DF2 TO WORK-CARD1.
457                 MOVE CCFC1 TO CCFC2.
458                 MOVE CSENS TO WSENS1.
459                 READ DRUM-FILE2 AT END GO TO INPUT-FILE1.
460                 MOVE DF2 TO NO-2-WORK-CARD2.
461                 IF CARD-NO2 NOT EQUAL 2 GO TO ABORT5.
462                 ADD 1 TO D2-CNT.
463                 IF WF-CK1(1) NUMERIC GO TO  INPUT-FILE2.
464             IF2-EXIT.
465                 GO TO RDC1.
466             SET-ALT-FUNC SECTION.
467             SAF1.
468                 IF      DALT-FUNC(TALLY) = SPACE
469                         MOVE CALT-FUNC TO CALT-FUNC2
470                         GO TO SAF-EXIT.
471                 PERFORM SET-SAF-FLAGS.
472                 IF      SAF-F1 = 'K' AND SAF-F2 = 'K' GO TO ALT-MESSAGE.
473                 IF      SAF-F1 = 'K' MOVE DALT-FUNC(TALLY) TO
474                         CALT-FUNC2    GO TO SAF-EXIT.
475                 IF CALT-FUNC = SPACE MOVE DALT-FUNC(TALLY) TO
476                         CALT-FUNC2 ELSE MOVE CALT-FUNC TO CALT-FUNC2.
477                 GO TO   SAF-EXIT.
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478             SET-SAF-FLAGS.
479                 MOVE    SPACE TO SAF-F1, SAF-F2.
480                 IF      DK-FAC1(TALLY) = 'K' OR DK-FAC2(TALLY) = 'K'
481                         MOVE 'K' TO SAF-F1.
482                 IF      CCON-FAC(1) = 'K' OR
483                         CCON-FAC(2) = 'K' OR
484                         CCON-FAC(3) = 'K' OR
485                         CCON-FAC(4) = 'K'
486                         MOVE 'K' TO SAF-F2.
487             SAF-EXIT.
488                 EXIT.
489             MISC SECTION.
490             OUTPUT-FILE1.
491                 WRITE DF1 FROM WORK-CARD2.
492                 WRITE DF1 FROM NO-2-WORK-CARD2.
493                 WRITE TR1 FROM WORK-CARD2.
494                 WRITE TR1 FROM  NO-2-WORK-CARD2.
495                 ADD 1 TO PATH-CNT.
496             OUTPUT-FILE2.
497                 WRITE DF2 FROM WORK-CARD2.
498                 WRITE DF2 FROM NO-2-WORK-CARD2.
499                 WRITE TR1 FROM WORK-CARD2.
500                 WRITE TR1 FROM  NO-2-WORK-CARD2.
501                 ADD 1 TO PATH-CNT.
502             FINAL-OUTPUT.
503                 WRITE PRINT-LINE FROM WORK-CARD2.
504                 WRITE PRINT-LINE FROM NO-2-WORK-CARD2.
505             ABORT9.
506                 MONITOR RUN-CNT, PATH-CNT.
507                 GO TO END-RUN.
508             ABORT5.
509                 MONITOR CARD1.
510                 CLOSE AS200-T1.
511                 STOP RUN.
512             ALPHA-NOT-FOUND.
513                 MOVE 99 TO ANF.
514                 MONITOR FA1.
515                 GO TO FF-EXIT.
516             SHIFT-ALPHA.
517                 MOVE APD(8) TO APD(9).
518                 MOVE APD(7) TO APD(8).
519                 MOVE APD(6) TO APD(7).
520                 MOVE APD(5) TO APD(6).
521                 MOVE APD(4) TO APD(5).
522                 MOVE APD(3) TO APD(4).
523                 MOVE APD(2) TO APD(3).
524                 MOVE APD(1) TO APD(2).
525                 MOVE WFUNC1(8) TO APD(1).
526                 MOVE WFUNC1(7) TO WFUNC2(8).
527                 MOVE WFUNC1(6) TO WFUNC2(7).
528                 MOVE WFUNC1(5) TO WFUNC2(6).
529                 MOVE WFUNC1(4) TO WFUNC2(5).
530                 MOVE WFUNC1(3) TO WFUNC2(4).
531                 MOVE WFUNC1(2) TO WFUNC2(3).
532                 MOVE WFUNC1(1) TO WFUNC2(2).
533             SHIFT-ALPHA1.
534                 MOVE APD(8) TO APD(9).
535                 MOVE APD(7) TO APD(8).
536                 MOVE APD(6) TO APD(7).
537                 MOVE APD(5) TO APD(6).
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538                 MOVE APD(4) TO APD(5).
539                 MOVE APD(3) TO APD(4).
540                 MOVE APD(2) TO APD(3).
541                 MOVE APD(1) TO APD(2).
542                 MOVE WFUNC2(8) TO APD(1).
543                 MOVE  WFUNC2(7) TO WFUNC2(8).
544                 MOVE  WFUNC2(6) TO WFUNC2(7).
545                 MOVE  WFUNC2(5) TO WFUNC2(6).
546                 MOVE  WFUNC2(4) TO WFUNC2(5).
547                 MOVE  WFUNC2(3) TO WFUNC2(4).
548                 MOVE  WFUNC2(2) TO WFUNC2(3).
549             SET-CON-FAC.
550                 IF CCON-FAC(1) EQUAL SPACE MOVE DK-FAC(TALLY) TO
551                         CCON-FAC2(1)  GO TO SET-CON-FAC1.
552                 IF CCON-FAC(2) EQUAL SPACE MOVE DK-FAC(TALLY) TO
553                         CCON-FAC2(2)  GO TO SET-CON-FAC1.
554                 IF CCON-FAC(3) EQUAL SPACE MOVE DK-FAC(TALLY) TO
555                         CCON-FAC2(3)  GO TO SET-CON-FAC1.
556                 IF CCON-FAC(4) EQUAL SPACE MOVE DK-FAC(TALLY) TO
557                         CCON-FAC2(4)  GO TO SET-CON-FAC1.
558                 IF DK-FAC2(TALLY) = SPACE GO TO SET-CON-FAC1.
559                 IF CCON-FAC(2) = SPACE MOVE DK-FAC2(TALLY) TO CCON-FAC2(2)
560                         GO TO SET-CON-FAC1.
561                 IF CCON-FAC(3) = SPACE MOVE DK-FAC2(TALLY) TO CCON-FAC2(3)
562                         GO TO SET-CON-FAC1.
563                 IF CCON-FAC(4) = SPACE MOVE DK-FAC2(TALLY) TO CCON-FAC2(4)
564                         GO TO SET-CON-FAC1.
565             SET-CON-FAC1.
566                 EXIT.
567             PW-CALC.
568                 MOVE WS2(TLLY2) TO CONV2.
569                 PERFORM CONVERSION1.
570                 COMPUTE  CSENS2(TLLY2) ROUNDED = WSENS (TLLY2) * R
571                         ON SIZE ERROR  MOVE 1 TO CSENS2(TLLY2).
572             PW-CALC.
573                 COMPUTE  CSENS2(TLLY2) ROUNDED = WSENS (TLLY2) * R
574                         ON SIZE ERROR  MOVE 1 TO CSENS2(TLLY2).
575             CONVERSION1.
576                 IF CONV2 EQUAL 'A' MOVE 1 TO R.
577                 IF CONV2 EQUAL '1' MOVE .1 TO R.
578                 IF CONV2 EQUAL '2' MOVE .2 TO R.
579                 IF CONV2 EQUAL '3' MOVE .3 TO R.
580                 IF CONV2 EQUAL '4' MOVE .4 TO R.
581                 IF CONV2 EQUAL '5' MOVE .5 TO R.
582                 IF CONV2 EQUAL '6' MOVE .6 TO R.
583                 IF CONV2 EQUAL '7' MOVE .7 TO R.
584                 IF CONV2 EQUAL '8' MOVE .8 TO R.
585                 IF CONV2 EQUAL '9' MOVE .9 TO R.
586                 IF CONV2 EQUAL '0' MOVE .0 TO R.
587                 IF CONV1 = '0' MOVE .0 TO RR.
588             EOF-ON-TAPE.
589                 CLOSE AS200-T1 WITH NO REWIND.
590                 OPEN OUTPUT AS200-T1 WITH NO REWIND.
591                 MONITOR RUN-CNT.
592             END-RUN.
593                 MONITOR PATH-CNT.
594                 CLOSE   AS200-T1  AS200-R1.
595                 STOP RUN.
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CROSS REFERENCE LIST

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0034          AS100-T2      0013  0034
0036          AS200-CD      0014  0036
0026          AS200-R1      0015  0026
0020          AS200-T1      0011  0020
0028          DRUM-FILE1    0016  0028
0031          DRUM-FILE2    0017  0031
0509         *ABORT5         OF   MISC   0437  0462
0506         *ABORT9         OF   MISC   0427  0452
0513         *ALPHA-NOT-FOUND      OF   MISC   0227  0227  0227  0243  0249
0308         *ALT-MESSAGE   OF    PICK-  0472
0378         *CARD-INPUT    0168  0179   0412
0287         *CHECK-FOR-LOOP       OF   PICK-  0278  0278  0278
0576         *CONVERSION1   OF    MISC   0328  0328  0328  0569  0569  0569
0414         *CS-EXIT       OF    CARD-
0378         *CS1      OF    CARD-
0383         *CS2      OF    CARD-  0378
0183         *END-OF-CARDS         OF   READ-  0410
0593         *END-RUN       OF    MISC   0423  0448  0507
0589         *EOF-ON-TAPE   OF    MISC
0251         *FF-EXIT       OF    FIND-  0224  0227  0243  0249  0251  0515
0211         *FF1      OF    FIND-
0223         *FF11     OF    FIND-
0226         *FF5      OF    FIND-  0214  0214  0214
0235         *FF6      OF    FIND-  0218  0218  0218
0245         *FF7      OF    FIND-  0221  0221  0221
0503         *FINAL-OUTPUT         OF   MISC   0280  0280  0280  0281  0281  0281  0340  0340  0340  0341
               0341  0341
0211         *FIND-ALPHA    0176  0176  0176
0440         *IF1-EXIT      OF    INPUT
0418         *IF11     OF    INPUT
0429         *IF12     OF    INPUT  0418
0465         *IF2-EXIT      OF    INPUT
0443         *IF21     OF    INPUT
0454         *IF22     OF    INPUT  0443
0418         *INPUT-FILE1   0383  0454  0459  0180  0438
0443         *INPUT-FILE2   0429  0434  0181  0463
0491         *MISC
0202         *OS-EXIT       OF    OUTPU  0195  0198  0202
0193         *OS1      OF    OUTPU
0197         *OS2      OF    OUTPU  0195  0195  0195
0491         *OUTPUT-FILE1         OF   MISC   0282  0282  0282  0284  0284  0284  0342  0342  0342  0344
               0344  0344
0497         *OUTPUT-FILE2         OF   MISC   0283  0283  0283  0343  0343  0343
0193         *OUTPUT-SEC    0178  0178  0178
0260         *PICK-UP-INPUTS       0200  0200  0200
0324         *PICK-UP-WUCS         0200  0200  0200
0568         *PU-CALC       OF    MISC   0274  0274  0274
0313         *PU-DUMBY      OF    PICK-
0315         *PU-EXIT       OF    PICK-  0262  0264  0280  0312  0315
0200         *PU1      OF    PICK-
0206         *PU2      OF    PICK-  0263  0263  0263
0573         *PW-CALC       OF    MISC   0336  0336  0336
0324         *PW1      OF    PICK-
0160         *P0       OF    $$AAB
0171         *RDC1     OF    READ-  0415  0440  0465
0179         *RDC11    OF    READ-  0176
0171         *READ-DATA-CARDS
0488         *SAF-EXIT      OF    SET-A  0470  0475  0477  0488
0468         *SAF1     OF    SET-A
0468         *SET-ALT-FUNC         0270  0270  0270
0550         *SET-CON-F/C   OF    MISC   0269
0506         *SET-CON-FAC1         OF   MISC   0269  0269  0551  0553  0555  0557  0558  0560  0562  0564
               0566
0479         *SET-SAF-FLAGS        OF   SET-A  0471  0471  0471
0517         *SHIFT-ALPHA   OF    MISC   0171  0171  0171
0534         *SHIFT-ALPHA1         OF   MISC   0329  0329  0329
0360         *TAPE-INPUT    0166  0166  0166
0369         *TI-EXIT       OF    TAPE-  0366  0364  0369
0360         *TI1      OF    TAPE-
0366         *TI2      OF    TAPE-  0363  0363  0363
0140          ADDITIONAL-PATH-DATA      OF   NO-2-
0062          ANF      OF    WORK1  0174  0176  0227  0243  0249  0513
0141          APD      OF    ADDIT  0295  0296  0297  0298  0299  0300  0301  0517  0517  0518  0518  0519
               0519  0520  0520  0521  0521  0522  0522  0523  0523  0524  0524  0526  0534  0534  0535
               0535  0536  0536  0537  0537  0538  0538  0539  0539  0540  0540  0541  0541  0543
0034          AS100-T2      0360  0363  0366
0036          AS200-CD      0161  0167  0167  0185  0383  0383  0409
0026          AS200-R1      0162  0185  0594
0020          AS200-T1      0163  0510  0589  0590  0594
0114          CALT-FUNC     OF    WORK-  0332  0470  0475  0476
0129          CALT-FUNC2    OF    WORK-  0332  0470  0474  0476  0476
0115          CALT-LR       OF    WORK-
0130          CALT-LR2      OF    WORK-
0120          CARD-NO       OF    WORK-  0406
0135          CARD-NO1      OF    WORK-  0277  0339
0143          CARD-NO2      OF    NO-2-  0278  0340  0436  0461
0037          CARD1     OF    AS200  0411  0509
0116          CCFC1     OF    WORK-  0267  0324  0432  0457
0131          CCFC2     OF    WORK-  0267  0324  0408  0432  0457
0117          CCON-FAC      OF    CCFC1  0482  0483  0484  0485  0550  0552  0554  0556  0559  0561  0563
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0132        CCON-FAC2       OF    CCFC2   0581  0583  0586  0587  0560  0562  0564
0080        CONTROL-CARD          OF    WORKI   0167
0052        CONV1   OF    WORKI   0587
0053        CONV2   OF    WORKI   0527  0569  0576  0577  0578  0579  0580  0581  0582  0583  0584  0585
              0586
0054        CONV3   OF    WORKI
0118        CSENS   OF    WORK-   0407  0433  0458
0133        CSENS2          OF    WORK-   0570  0571  0573  0574
0047        C1-CNT          OF    WORKI   0378  0411
0091        DALPHA          OF    DA1     0271  0331
0092        DALPHA1         OF    DALPH
0093        DALPHA2         OF    DALPH
0103        DALT-FUNC       OF    DA1     0469  0474  0476
0089        DATA-ARRAY1     OF    WORKI
0105        DATA-ARRAY2     OF    WORKI
0049        DA-IND          OF    WORKI   0193  0198  0224
0090        DA1     OF    DATA-
0106        DA2     OF    DATA-   0367
0095        DDEP-FUNC       OF    DA1     0198  0198  0240
0096        DDEP-FUNC1      OF    DDEP-   0228  0230  0231  0233  0235  0237  0238  0245
0097        DDEP-FUNC2      OF    DDEP-   0229  0232  0236  0239  0246
0030        DF1     OF    DRUM-   0431  0435  0491  0491  0492  0493
0033        DF2     OF    DRUM-   0456  0460  0497  0497  0498  0499
0151        DIAG-1          OF    WORKI   0308
0100        DK-FAC          OF    DA1     0551  0553  0555  0557
0101        DK-FAC1         OF    DK-FA   0268  0480

0102        DK-FAC2         OF    DK-FA   0480  0558  0559  0561  0563
0099        DPH-SENS        OF    DA1     0267
0028        DRUM-FILE1      0164  0421  0422  0429  0434  0446  0447
0031        DRUM-FILE2      0164  0421  0422  0446  0447  0454  0459
0104        DTYPE   OF    DA1     0260  0262
0094        DWUC    OF    DA1     0330
0098        DWUC-SENS       OF    DA1     0199  0327
0044        D1-CNT          OF    WORKI   0418  0426  0437  0448  0449  0451
0045        D2-CNT          OF    WORKI   0381  0423  0424  0426  0443  0451  0462
0113        EXTRA-SPACE     OF    WORK-
0128        EXTRA-SPACE2          OF    WORK-
0051        FALR    OF    WORKI   0173  0229  0232  0236  0239  0246
0056        FA1     OF    WORKI   0173  0228  0230  0231  0235  0237  0238  0245  0514
0057        FA2     OF    WORKI
0071        IC1     OF    INTER   0386
0072        IC2     OF    INTER   0387  0389  0391  0393  0395  0397  0399  0401  0403
0073        IC21    OF    INTER
0074        IC3     OF    IC21    0388  0390  0392  0394  0396  0398  0400  0402  0404
0075        IC4     OF    INTER   0405
0076        IC5     OF    INTER   0406
0138        IDENTIFIER-1          OF    NO-2-   0275  0288  0289  0290  0291  0292  0293  0294  0295  0296
              0297  0298  0299  0300  0301  0337
0139        IDENTIFIER-2          OF    NO-2-   0276  0338
0070        INTER-CARD      OF    WORKI   0383
0077        INT-C1          OF    WORKI   0407
0083        ITER-CNT        OF    CONTR   0427  0452
0058        LOOP-CK         OF    WORKI   0279  0287  0289  0290  0291  0292  0293  0294  0295  0296  0297
              0298  0299  0300  0301  0302  0302  0303  0305
0149        LOOP-LINE       OF    WORKI   0303
0069        MA-IND          OF    WORKI
0137        NO-2-WORK-CARD2       OF    WORKI   0306  0310  0326  0346  0385  0411  0430  0435  0455  0460
              0493  0494  0499  0500  0504
0042        PATH-CNT        OF    WORKI   0495  0501  0506  0593
0119        PATH-COMP       OF    WORK-   0405
0134        PATH-COMP2      OF    WORK-   0333  0349
0087        PO-ALL          OF    CONTR   0281  0341
0085        PO-CNT          OF    CONTR   0280  0340
0027        PRINT-LINE      OF    AS200   0302  0303  0304  0304  0306  0306  0308  0308  0309  0309  0310
              0310  0503  0503  0504  0504
0059        PUNCH-CNT       OF    WORKI   0166  0183  0285  0348
0066        R       OF    WORKI   0571  0574  0577  0577  0578  0579  0580  0581  0582  0583  0584  0585
              0586
0041        READ-CONTROL          OF    WORKI   0179  0180  0181  0282  0283  0284  0342  0343  0344  0379
              0419  0420  0444  0445
0067        RR      OF    WORKI   0587
0068        RRR     OF    WORKI
0043        RUN-CNT         OF    WORKI   0280  0340  0381  0426  0427  0451  0452  0506  0591
0039        SAF-F1          OF    WORKI   0472  0473  0479  0481
0040        SAF-F2          OF    WORKI   0472  0479  0486
              0331  0361  0363  0361  0367  0469  0474  0476  0480  0480  0551  0553  0555  0557  0558
              0559  0561  0563
0035        TAPE-REC        OF    AS100   0367
0050        TLLY1   OF    WORKI
0048        TLLY2   OF    WORKI   0272  0274  0272  0334  0336  0334  0568  0570  0570  0571  0573  0573
              0574
0060        TLY     OF    WORKI   0212  0212  0214  0214  0215  0216  0216  0218  0218  0219  0220  0220
              0221  0224  0226  0228  0229  0230  0231  0232  0233  0235  0236  0237  0238  0239  0240
              0245  0246
0022        TR1     OF    AS200   0493  0493  0494  0494  0499  0499  0500  0500
0023        TR11    OF    TR1
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                0024                TR12   OF   TR1
                0025                TR13   OF   TR1
                0061                TYPE-RUN     OF   CONTR  0262
                0112                WFLR   OF   WFUNC  0173
                0127                WFLR2  OF   WFUNC
                0108                WFUNC1       OF   WORK-  0414  0525  0526  0527  0528  0529  0530  0531  0532
                0123                WFUNC2       OF   WORK-  0271  0275  0276  0288  0289  0290  0291  0292  0293  0294  0330
                                     0331  0337  0338  0526  0527  0528  0529  0530  0531  0532  0542  0543  0543  0544  0544
                                     0545  0545  0546  0546  0547  0547  0548  0548
                0110                WF-CK1       OF   WF1    0412  0438  0463
                0125                WF-CK2       OF   WF2
                0108                WF1    OF   WFUNC  0173
                0111                WF11   OF   WF1
                0124                WF2    OF   WFUNC
                0126                WF2-   OF   WF2
                0107                WORK-CARD1   OF   WORKI  0309  0386  0431  0456
                0122                WORK-CARD2   OF   WORKI  0304  0325  0345  0385  0430  0455  0491  0493  0497  0499  0509
                0146                WORK-CARD3   OF   WORKI  0325  0345
                0145                WORK-CARD99  OF   WORKI  0326  0346
                0079                WSENS  OF   WSENS  0387  0388  0389  0390  0391  0392  0393  0394  0395  0396  0397  0398
                                     0399  0400  0401  0402  0403  0404  0571  0574
                0078                WSENS1       OF   INT-C  0433  0458
                0147                WSENS2       OF   WORKI  0267
                0148                WS2    OF   WSENS  0569
                0046                WUC-CNT      OF   WORKI
                0064                X      OF   WORKI  0215  0216  0219  0220
                0063                Y      OF   WORKI  0216  0219  0241  0242  0247  0248  0313
                0055                Z      OF   WORKI
                0065                ZZ     OF   WORKI
                0061                ZZZ    OF   WORKI  0211  0214  0216  0218  0219  0221  0229  0230  0233  0233  0236  0237
                                     0240  0240  0246  0285
    ERROR       0563        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0561        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0559        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0558        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0557        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0555        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0553        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0551        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0481        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0481        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0476        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0474        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0469        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0367        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0331        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0330        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0327        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0271        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0268        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0267        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0262        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0262        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0219        NO ON SIZE ERROR, OVERFLOW POSSIBLE
    ERROR       0215        NO ON SIZE ERROR, OVERFLOW POSSIBLE
    ERROR       0199        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
    ERROR       0198        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
```

PROGRAM: AS300A

Input: AS200-T1 (Path/sensitivity tape)

Output: AS300-T1 (Sorted path/sensitivity tape)

Purpose: Sort the path/sensitivity tape (AS200-T1) from AS200A by WUC, ALPHA-DESIG, K-FACTORS. If this is a functional path tape, this is the final output.

```
15:40:39    PROF COR AS300A,AS300A
 UCC COBOL VERSION 3.0LA
COMPILED ON -  11 JAN 70 AT 15:40:39
                1                       IDENTIFICATION DIVISION.
                2                       PROGRAM-ID.     AS300A.
                3                       AUTHOR. ROBT RITTER.
                4                       REMARKS.        SORT PATH TAPE DROPPING 2 CARDS.
                5                       ENVIRONMENT DIVISION.
                6                       CONFIGURATION SECTION.
                7                       SOURCE-COMPUTER. UNIVAC-1108.
                8                       OBJECT-COMPUTER. UNIVAC-1108.
                9                       INPUT-OUTPUT SECTION.
               10                       FILE-CONTROL.
               11                           SELECT AS300-CD ASSIGN TO CARD-READER-EIGHTY.
               12                           SELECT AS200-T1 ASSIGN TO UNISERVO H
               13                               RESERVE 2 ALTERNATE AREAS.
               14                           SELECT AS300-R1 ASSIGN TO PRINTER.
               15                           SELECT AS300-T1 ASSIGN TO UNISERVO F
               16                               RESERVE 2 ALTERNATE AREAS.
               17                           SELECT FSORT ASSIGN TO DRUM 1500000 WORDS.
               18                       DATA DIVISION.
               19                       FILE SECTION.
               20                       FD AS200-T1   LABEL RECORD OMITTED DATA RECORD TR2
               21                            BLOCK CONTAINS 40 RECORDS.
               22                       01 TR2.
               23                           02 T-WUC.
               24                               03 T1 PICTURE X.
               25            0 1                03 T11 PICTURE XXXXXX.
               26            1 1            02 T-WUCALPHA PICTURE X(7).
               27            2 2            02 FILLER PIC X(42).
               28            9 2            02 TALT PIC X(6).
               29           10 4            02 TK-FAC PIC XXXX.
               30           11 2            02 TPH-SENS PIC X(36).
               31           17 2            02 FILLER PICTURE X.
               32           17 3            02 T3 PICTURE 99.
               33           17 5            02 FILLER PIC X.
               34                       FD AS300-CD LABEL RECORD OMITTED DATA RECORD CARD1 CARD2.
               35                       01 CARD1.
               36                           02 C1 PICTURE X(7).
               37            1 1            02 C2 PICTURE X(7).
               38            2 2            02 C3 PICTURE X(66).
               39                       01 CARD2.
               40                           02 C4 PICTURE XXXX.
               41            0 4            02 FILLER PICTURE XXXXX.
               42            1 3            02 C5 PICTURE XXXXXXX.
               43            2 4            02 FILLER PICTURE XXXXX.
               44            3 3            02 C7 PICTURE XXXX.
               45            4 1            02 FILLER PICTURE X(53).
               46           13 0            02 C9 PICTURE XX.
               47                       FD AS300-T1 LABEL RECORD OMITTED DATA RECORD REC1
               48                            BLOCK CONTAINS 40 RECORDS.
               49                       01 REC1 PICTURE X(80).
               50                       FD AS300-R1 LABEL RECORD OMITTED DATA RECORD PRINT-LINE.
               51                       01 PRINT-LINE PICTURE X(132).
               52                       SD FSORT FILE CONTAINS ABOUT 60000 RECORDS DATA RECORD FSORT1
               53                       01 FSORT1.
               54                           02 F1 PICTURE X(7).
               55            1 1            02 F2 PICTURE X(7).
               56            2 2            02 F3 PICTURE XXXX.
               57            3 0            02 F4 PIC X(36).
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58      9 0             02 F5 PICTURE XXXX.
59      9 4             02 F6 PICTURE XX.
60     10 0             02 F7 PIC X(8).
61     10 0         WORKING-STORAGE SECTION.
62                  77 REC-CNT PICTURE 99999.
63      1 0         77 P-CNT PICTURE 99.
64      2 0         77 T-CNT PICTURE 99999999.
65      2 0         PROCEDURE DIVISION.
66                  P0.
67                      OPEN INPUT AS300-CD.
68                      OPEN OUTPUT AS300-T1.
69                      OPEN OUTPUT AS300-R1.
70                      OPEN INPUT AS200-T1.
71                      MOVE 0 TO REC-CNT.
72                      MOVE 0 TO P-CNT.
73                      MOVE 0 TO T-CNT.
74                      SORT FSORT ON ASCENDING KEY F1, F2, F5 F7 INPUT PROCEDURE IS
75                          IN- EC OUTPUT PROCEDURE IS OUT-SEC.
76                      MONITOR REC1.
77                      CLOSE AS300-T1 AS300-CD AS300-R1 AS200-T1.
78                      MONITOR REC-CNT.
79                      STOP RUN.
80                  IN-SEC SECTION.
81                  IS1.
82                      ADD 1 TO REC-CNT.
83                      MOVE SPACE TO FSORT1.
84                      READ AS300-CD AT END GO TO READ-TAPE.
85                      IF C4 EQUAL 'AFPH' GO TO FAILURE-CARD.
86                      GO TO IS1.
87                  FAILURE-CARD.
88                      MOVE C5 TO F1.
89                      MOVE C7 TO F3.
90                      MOVE C9 TO F6.
91                      RELEASE FSORT1.
92                      GO TO IS1.
93                  READ-TAPE.
94                      READ AS200-T1   AT END GO TO IS-EXIT.
95                      IF T3 NOT EQUAL 01 GO TO READ-TAPE.
96                      MOVE T-WUC TO F1.
97                      MOVE T-WUCALPHA TO F2.
98                      MOVE TK-FAC TO F5.
99                      MOVE TPH-SENS TO F4.
100                     MOVE    TALT TO F7.
101                     RELEASE FSORT1.
102                     ADD 1 TO T-CNT.
103                     ADD 1 TO REC-CNT.
104                     GO TO READ-TAPE.
105                 IS-EXIT.
106                     EXIT.
107                 OUT-SEC SECTION.
108                 OS1.
109                     RETURN FSORT RECORD AT END GO TO OS-EXIT.
110                     MOVE FSORT1 TO REC1.
111                     WRITE REC1.
112                     ADD 1 TO P-CNT.
113                     IF P-CNT LESS THAN 5
114                     WRITE PRINT-LINE FROM FSORT1.
115                     GO TO OS1.
116                 OS-EXIT.
117                     EXIT.
```

CROSS REFERENCE LIST

```
0020          AS200-T1      0012  0020
0034          AS300-CD      0011  0034
0050          AS300-R1      0014  0050
0047          AS300-T1      0015  0047
0052          FSORT  0017   0052
0088          *FAILURE-CARD       OF    IN-SE  0085
0082          *IN-SEC       0075  0075  0075
0106          *IS-EXIT      OF    IN-SE  0095  0106
0082          *IS1    OF    IN-SE 0086  0092
0117          *OS-EXIT      OF    OUT-S  0109  0117
0109          *OS1    OF    OUT-S 0115
0109          *OUT-SEC      0075  0075  0075
0066          *P0     OF    $$AAB
0094          *READ-TAPE    OF    IN-SE  0085  0095  0104
0020          AS200-T1      0070  0077  0094
0034          AS300-CD      0067  0077  0084
0050          AS300-R1      0069  0077
0047          AS300-T1      0068  0077
0035          CARD1   OF    AS300
0039          CARD2   OF    AS300
0036          C1      OF    CARD1
0037          C2      OF    CARD1
0038          C3      OF    CARD1
0040          C4      OF    CARD2 0085
0042          C5      OF    CARD2 0088
0044          C7      OF    CARD2 0089
0046          C9      OF    CARD2 0090
0052          FSORT  0074   0075  0075  0109
0053          FSORT1        OF    FSORT  0083  0091  0101  0110  0114
0054          F1      OF    FSORT 0074  0088  0096
0055          F2      OF    FSORT 0074  0097
0056          F3      OF    FSORT 0089
0057          F4      OF    FSORT 0099
0058          F5      OF    FSORT 0074  0098
0059          F6      OF    FSORT 0090
0060          F7      OF    FSORT 0074  0101
0051          PRINT-LINE    OF    AS300  0114  C114
0063          P-CNT   OF    WORKI 0072  0112  0114
0062          REC-CNT       OF    WORKI  0071  0078  0082  0103
0049          REC1    OF    AS300 0077  0110  0111
0028          TALT    OF    TR2   0101
0029          TK-FAC        OF    TR2   0098
0030          TPH-SENS      OF    TR2   0099
0022          TR2     OF    AS200
0064          T-CNT   OF    WORKI 0073  0102
0023          T-WUC   OF    TR2   0096
0026          T-WUCALPHA    OF    TR2   0097
0024          T1      OF    T-WUC
0025          T11     OF    T-WUC
0032          T3      OF    TR2   0095
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COBOL COMPILATION TIME 2 SECONDS.

PROGRAM: AS400A

Inputs: AS300-T1 (Path/sensitivity tape)

Output: AS400-T1 (Combined path/sensitivity tape)

Purpose: For sensitivity path runs only, paths are combined under the same WUC with the same Provisory Factors.

Method: The input tape is sorted on WUC, ALPHA, K-FACTOR (Provisory Factor). Sensitivity combining is done first within K-factors having the same ALPHA, using $1-(1-S_1)(1-S_2)(1-S_n)$. When there is more than one ALPHA for a WUC sensitivities of each ALPHA are combined using $S_1 + S_2 + S_n$/#ALPHAS, where #ALPHAS is the number of ALPHAS for this WUC. The final result is one record for each WUC/Provisory Factor combination.

```
12:29:50    @BUR COB AS400A,AS400A
 UCC COBOL VERSION 3.0LA
COMPILED ON =  17 JAN 70 AT 12:29:50
                    1                       IDENTIFICATION DIVISION.
                    2                       PROGRAM-ID.     AS400A.
                    3                       AUTHOR. ROBT KITTER.
                    4                       REMARKS.        SENSITIVITY PATH COMBINE.
                    5                       ENVIRONMENT DIVISION.
                    6                       CONFIGURATION SECTION.
                    7                       SOURCE-COMPUTER. UNIVAC-1108.
                    8                       OBJECT-COMPUTER. UNIVAC-1108.
                    9                       INPUT-OUTPUT SECTION.
                   10                       FILE-CONTROL.
                   11                           SELECT KSORT ASSIGN TO DRUM 100 WORDS.
                   12                           SELECT AS200-T1  ASSIGN TO UNISERVO F
                   13                               RESERVE 4 ALTERNATE AREAS.
                   14                           SELECT AS400-T1 ASSIGN TO UNISERVO H
                   15                               RESERVE 4 ALTERNATE AREAS.
                   16                           SELECT AS400-R1 ASSIGN TO PRINTER.
                   17                           SELECT AS400-CD ASSIGN TO CARD-READER-EIGHTY.
                   18                           SELECT FSORT ASSIGN TO DRUM 1000 WORDS.
                   19                       DATA DIVISION.
                   20                       FILE SECTION.
                   21                       SD KSORT FILE CONTAINS ABOUT 4 RECORDS DATA RECORD KSORT1.
                   22                       01 KSORT1.
                   23                           02 KS1 PICTURE X.
                   24                       FD AS400-CD LABEL RECORDS OMITTED DATA RECORD CARD1.
                   25                       01 CARD1 PICTURE X(80).
                   26                       FD AS400-R1 LABEL RECORDS OMITTED DATA RECORD PRINT-LINE.
                   27                       01 PRINT-LINE PICTURE X(132).
                   28                       FD AS200-T1 LABEL RECORDS OMITTED DATA RECORD REC1
                   29                            BLOCK CONTAINS 40 RECORDS.
                   30                       01 REC1 PICTURE X(80).
                   31                       FD AS400-T1 LABEL RECORDS OMITTED DATA RECORDS FT1 FT2
                   32                            BLOCK CONTAINS 40 RECORDS.
                   33                       01 FT1.
                   34                           02 F1WUC PICTURE X(7).
                   35                1 1        02 F1ALPHA PICTURE X(7).
                   36                2 2        02 F1K-FAC PICTURE XXXX.
                   37                3 0        02 F1PH-SENS.
                   38                3 0            03 F1PS PICTURE 9V9(3) OCCURS 9 TIMES.
                   39                9 0        02 F1MISS-SENS PICTURE 9V9(3).
                   40                9 4        02 F1-ALPHAS PICTURE 99.
                   41               10 0        02 F1-ALT                    PIC X(8).
                   42                       01 FT2                          PIC X(68).
                   43                       SD FSORT FILE CONTAINS ABOUT 100 RECORDS DATA RECORD FSORT1.
                   44                       01 FSORT1.
                   45                           02 F1 PICTURE X(14).
                   46                2 2        02 FKEY PICTURE XXXX.
                   47                3 0        02 F2                        PIC X(50).
                   48                3 0        WORKING-STORAGE SECTION.
                   49                           77 TMS      PIC 99V9(12).
                   50                3 0        77 SPH2 PICTURE 9V999.
                   51                4 0        77 SPH3 PICTURE 9V999.
                   52                5 0        77 TALLY1 PICTURE 99999.
                   53                6 0        77 STOP-CNT PICTURE 99999 VALUE 0.
                   54                7 0        77 S1 PICTURE 9V999999999.
                   55                9 0        77 S2 PICTURE 9V999999999.
                   56               11 0        77 NO-ALPHAS PICTURE 99.
                   57               12 0        77 FT-CNT PICTURE 9(5).
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 58     13 0          77 PT-CNT PICTURE 9(6).
 59     14 0          77 AR-ENT PICTURE 9(5).
 60     15 0          77 OUT-CNT PICTURE 99999 VALUE 0.
 61     16 0          77 TLY PICTURE 9(5).
 62     17 0          77 CS1 PICTURE 9V9(3).
 63     18 0          77 CS2 PICTURE 9V9(3).
 64     19 0          01 K-ARRAY.
 65     19 0              02 K OCCURS 4 TIMES PICTURE X.
 66     20 0          01 ARRAY1.
 67     20 0              02 ARRAY-ENTRY OCCURS 100 TIMES.
 68     20 0                  03 AWUC PICTURE X(7).
 69     21 1                  03 AR-ALPHA PICTURE X(7).
 70     22 2                  03 AR-KFAC PICTURE X(4).
 71     23 0                  03 AR-PHSENS.
 72     23 0                      04 ARPS OCCURS 9 TIMES PICTURE 9V999.
 73     29 0                  03 AR-MISS PICTURE 9V999.
 74     29 4                  03 AN-ALPHAS PICTURE 99.
 75     30 0                  03 AR-ALT PIC X(8).
 76   1154 0          01 WORK-REC1.
 77   1154 0              02 W11 PICTURE X(7).
 78   1155 1              02 W12 PICTURE X(7).
 79   1156 2              02 W13 PICTURE X(4).
 80   1157 0              02 WS1 OCCURS 9 TIMES PIC 9V999.
 81   1163 0              02 WK-FAC.
 82   1163 0                  03  KF1   PIC X.
 83   1163 1                  03  KF2   PIC X.
 84   1163 2                  03  KF3   PIC X.
 85   1163 3                  03  KF4   PIC X.
 86   1163 4              02 W16 PICTURE XX.
 87   1164 0              02 WALT  PIC X(8).
 88   1165 2              02 FILLER PIC X(39).
 89   1172 0          01 WORK-REC2.
 90   1172 0              02 WUC PICTURE X(7).
 91   1173 1              02 ALPHA PICTURE X(7).
 92   1174 2              02 K-FAC PICTURE XXXX.
 93   1175 0              02 PH-SENS PICTURE 9V999 OCCURS 9 TIMES.
 94   1181 0              02 MISSION-SENS PICTURE 9V999.
 95   1181 4              02 NA PICTURE 99.
 96   1182 0              02 ALT  PIC X(8).
 97   1192 0          PROCEDURE DIVISION.
 98                   P0.
 99                       OPEN INPUT AS400-CD.
100                       OPEN INPUT  AS200-T1.
101                       OPEN OUTPUT AS400-R1.
102                       OPEN OUTPUT AS400-T1.
103                       MOVE 0 TO FT-CNT.
104                       MOVE 0 TO PT-CNT.
105                       MOVE 0 TO AR-ENT.
106                       MOVE 0 TO NO-ALPHAS.
107                  P1.
108                       READ AS200-T1  AT END GO TO END-RUN.
109                       MOVE REC1 TO WORK-REC1.
110                       IF W12 EQUAL SPACE GO TO P1.
111                  IN-SEC SECTION.
112                  IS1.
113                       PERFORM CLEAR-ARRAY VARYING TALLY FROM 1 BY 1 UNTIL TALLY
114                           GREATER THAN 100.
115                       MOVE 0 TO AR-ENT, MISSION-SENS.
116                       MOVE REC1 TO WORK-REC1.
117                       IF W12 EQUAL SPACE GO TO P1.
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118                 IF      W11 LESS THAN 'ZZZZZZZ'   GO TO P1.
119                 MOVE W11 TO WUC.
120                 IF WK-FAC NOT EQUAL SPACE PERFORM SORT-K-FACTORS.
121                 MOVE WK-FAC TO K-FAC.
122                 MOVE    WALT TO ALT.
123                 PERFORM SET-SENS1 VARYING TALLY FROM 1 BY 1 UNTIL TALLY
124                     GREATER THAN 9.
125                 MOVE W12 TO ALPHA.
126             IS2.
127                 READ AS200-T1  AT END GO TO FINISH-UP.
128                 MOVE REC1 TO WORK-REC1.
129                 IF W12 EQUAL SPACE GO TO IS2.
130                 IF      W11 LESS THAN 'ZZZZZZZ'   GO TO IS2.
131                 IF WK-FAC NOT EQUAL SPACE PERFORM SORT-K-FACTORS.
132                 IF W12 NOT EQUAL ALPHA OR WK-FAC NOT EQUAL K-FAC
133                     PERFORM SET-ARRAY-ENTRY.
134                 MOVE WK-FAC TO K-FAC.
135                 MOVE W12 TO ALPHA.
136                 MOVE    WALT TO ALT.
137                 IF W11 NOT EQUAL WUC GO TO OUTPUT-SEC.
138                 PERFORM COMBINE-SENS VARYING TALLY FROM 1 BY 1 UNTIL TALLY
139                     GREATER THAN 9.
140                 GO TO IS2.
141             OUTPUT-SEC SECTION.
142             OS1.
143                 SORT FSORT ON ASCENDING KEY FKEY INPUT PROCEDURE IS
144                     FIN OUTPUT PROCEDURE IS FOUT.
145                 PERFORM COMBINE-ALPHAS.
146                 MOVE 0 TO NO-ALPHAS.
147                 IF STOP-CNT LESS THAN 99 GO TO IS1.
148                 GO TO END-RUN.
149             COMBINE-ALPHAS.
150                 MOVE ARRAY-ENTRY(1) TO WORK-REC2.
151                 MOVE NO-ALPHAS TO NA. MOVE SPACE TO ALPHA.
152                 MOVE 2 TO TALLY1.
153                 IF AWUC(2) EQUAL SPACE PERFORM WRITE-TAPE-REC.
154                 MOVE 0 TO MISSION-SENS.
155                 PERFORM CA1 VARYING TALLY FROM 2 BY 1 UNTIL AWUC(TALLY1)
156                     EQUAL SPACE.
157             CA1.
158                 ADD 1, TALLY GIVING TALLY1.
159                 IF      AR-KFAC(TALLY) NOT EQUAL K-FAC OR
160                         ALT NOT EQUAL AR-ALT(TALLY)
161                         PERFORM WRITE-TAPE-REC.
162                 IF MISSION-SENS NOT EQUAL 9 AND
163                    AWUC(TALLY) LESS THAN 'ZZZZZZZ' PERFORM ADD-SENS1
164                     VARYING TLY FROM 1 BY 1 UNTIL TLY GREATER THAN 9.
165                 IF MISSION-SENS NOT EQUAL 9 AND AWUC(TALLY)
166                     GREATER THAN 'ZZZZZZZ'
167                 PERFORM ADD-SENS VARYING TLY FROM 1 BY 1 UNTIL TLY
168                     GREATER THAN 9.
169                 MOVE 0 TO MISSION-SENS.
170                 IF AR-KFAC(TALLY) EQUAL K-FAC AND AWUC(TALLY1) EQUAL
171                     SPACE PERFORM
172                     WRITE-TAPE-REC.
173             ADD-SENS1.
174                 COMPUTE PH-SENS(TLY) ROUNDED =
175                       PH-SENS(TLY) + ARPS(TALLY, TLY) *
176                       PH-SENS(TLY) * ARPS(TALLY, TLY)
177                     ON SIZE ERROR MONITOR PH-SENS(TALLY).
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178                 ADD-SENS.
179                     ADD ARPS(TALLY, TLY) TO PH-SENS(TLY).
180                 WRITE-TAPE-REC.
181                     IF NO-ALPHAS LESS THAN 1 MOVE 1 TO NO-ALPHAS.
182                     PERFORM  AVE-SENS VARYING TLY FROM 1 BY 1 UNTIL TLY
183                             GREATER THAN 9.
184                     PERFORM MISSION-SENSITIVITY.
185                     MOVE SPACE TO ALPHA.
186                     MOVE NO-ALPHAS TO NA.
187                     WRITE PRINT-LINE FROM WORK-REC2.
188                     WRITE FT1 FROM WORK-REC2.
189                     ADD 1 TO OUT-CNT.
190                     PERFORM CLEAR-PH-SENS VARYING TLY FROM 1 BY 1 UNTIL TLY
191                         GREATER THAN 9.
192                     MOVE ARRAY-ENTRY(TALLY) TO WORK-REC2.
193                     MOVE 9 TO MISSION-SENS.
194                 AVE-SENS.
195                     IF NO-ALPHAS EQUAL 0 MOVE 1 TO NO-ALPHAS.
196                     DIVIDE NO-ALPHAS INTO PH-SENS(TLY) GIVING PH-SENS(TLY)
197                         ON SIZE ERROR MONITOR NO-ALPHAS.
198                 OUTSEC-EXIT.
199                     EXIT.
200                 FIN SECTION.
201                 FS1.
202                     PERFORM FS2 VARYING TALLY FROM 1 BY 1 UNTIL TALLY
203                         GREATER THAN 100.
204                     GO TO FIN-EXIT.
205                 FS2.
206                     IF AWUC(TALLY) EQUAL SPACE GO TO FIN-EXIT.
207                     RELEASE FSORT1 FROM ARRAY-ENTRY(TALLY).
208                 FIN-EXIT.
209                     EXIT.
210                 FOUT SECTION.
211                 FO1.
212                     PERFORM CLEAR-ARRAY VARYING TALLY FROM 1 BY 1 UNTIL TALLY
213                         GREATER THAN 100.
214                     PERFORM FO2 VARYING TALLY FROM 1 BY 1 UNTIL  TALLY
215                         GREATER THAN 100.
216                     GO TO FIN-EXIT.
217                 FO2.
218                     RETURN FSORT RECORD INTO ARRAY-ENTRY(TALLY) AT END
219                         GO TO FOUT-EXIT.
220                 FOUT-EXIT.
221                     EXIT.
222                 SORT-K-FACTORS SECTION.
223                 SKS1.
224                     MOVE WK-FAC TO K-ARRAY.
225                     IF K(2) EQUAL SPACE AND K(3) EQUAL SPACE AND K(4) EQUAL
226                         SPACE GO TO SKS-EXIT.
227                     PERFORM SCRATCH-DUPS.
228                     MOVE K-ARRAY TO WK-FAC.
229                     IF K(2) EQUAL SPACE AND K(3) EQUAL SPACE AND K(4) EQUAL
230                         SPACE GO TO SKS-EXIT.
231                     SORT KSORT ON ASCENDING KEY KS1 INPUT PROCEDURE IS
232                         KIN OUTPUT PROCEDURE IS KOUT.
233                     MOVE K-ARRAY TO WK-FAC.
234                     GO TO SKS-EXIT.
235                 SCRATCH-DUPS.
236                     IF K(1) EQUAL K(2) MOVE SPACE TO K(2).
237                     IF K(1) EQUAL K(3) MOVE SPACE TO K(3).
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238                 IF K(1) EQUAL K(4) MOVE SPACE TO K(4).
239                 IF K(2) EQUAL K(3) MOVE SPACE TO K(3).
240                 IF K(2) EQUAL K(4) MOVE SPACE TO K(4).
241                 IF K(3) EQUAL K(4) MOVE SPACE TO K(4).
242             SKS-EXIT.
243                 EXIT.
244             KIN SECTION.
245             KS1.
246                 PERFORM KS2 VARYING TALLY FROM 1   BY 1 UNTIL TALLY
247                     GREATER THAN 4.
248                 GO TO KIN-EXIT.
249             KS2.
250                     K(TALLY) NOT EQUAL SPACE RELEASE KSORT1 FROM K(TALLY).
251             KIN-
252                 E
253             KOUT SECTION.
254             KS3.
255                 MOVE SPACE TO K-ARRAY.
256                 PERFORM KS4 VARYING TALLY FROM 1 BY 1 UNTIL TALLY
257                     GREATER THAN 4.
258                 GO TO KOUT-EXIT.
259             KS4.
260                 RETURN KSORT RECORD INTO K(TALLY) AT END GO TO KOUT-EXIT.
261             KOUT-EXIT.
262                 EXIT.
263             MISC SECTION.
264             SET-SENS1.
265                 MOVE WS1(TALLY) TO PH-SENS(TALLY).
266             SET-ARRAY-ENTRY.
267                 ADD 1 TO AR-ENT.
268                 MOVE WORK-REC2 TO ARRAY-ENTRY(AR-ENT).
269                 IF W12 NOT EQUAL ALPHA ADD 1 TO NO-ALPHAS.
270                 PERFORM CLEAR-PH-SENS VARYING TLY FROM 1 BY 1 UNTIL TLY
271                     GREATER THAN 9.
272             CLEAR-ARRAY.
273                 MOVE SPACE TO ARRAY-ENTRY(TALLY).
274             MISSION-SENSITIVITY.
275                 MOVE PH-SENS(2) TO SPH2.
276                 MOVE PH-SENS(8) TO SPH8.
277                 COMPUTE PH-SENS(2) = PH-SENS(2) + PH-SENS(1) *
278                     PH-SENS(1) + PH-SENS(2)  ON SIZE ERROR
279                     MONITOR PH-SENS(1).
280                 COMPUTE PH-SENS(8) = PH-SENS(8) + PH-SENS(9) *
281                     PH-SENS(8) + PH-SENS(9)  ON SIZE ERROR
282                     MONITOR PH-SENS(9).
283                 COMPUTE S1 ROUNDED = (PH-SENS(2) + PH-SENS(8)) * (PH-SENS(2)
284                     * PH-SENS(8)) ON SIZE ERROR MONITOR PH-SENS(2).
285                 COMPUTE S2 ROUNDED =
286                     (PH-SENS(3) * 5.1 + PH-SENS(4) * 26.8 + PH-SENS(5) *
287                     23.1 + PH-SENS(6) * 26.8 + PH-SENS(7) * 6.4) / 88.2
288                     ON SIZE ERROR MONITOR PH-SENS(2).
289                 COMPUTE MISSION-SENS ROUNDED = S1 + S2 - S1 * S2 ON SIZE
290                     ERROR MONITOR S1.
291                 MOVE SPH2 TO PH-SENS(2).
292                 MOVE SPH8 TO PH-SENS(8).
293             CLEAR-PH-SENS.
294                 MOVE 0 TO PH-SENS(TLY).
295             COMBINE-SENS.
296                 MOVE PH-SENS(TALLY) TO CS1.
297                 MOVE WS1(TALLY) TO CS2.
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298                 COMPUTE PH-SENS(TALLY) ROUNDED = CS1 + CS2 - CS1 * CS2
299                     ON SIZE ERROR MONITOR PH-SENS(TALLY).
300             FINISH-UP.
301                 MOVE 999 TO STOP-CNT.
302                 MOVE    'ZZZZ' TO W12.
303                 PERFORM SET-ARRAY-ENTRY.
304                 PERFORM OUTPUT-SEC.
305             END-RUN.
306                 MONITOR OUT-CNT.
307                 CLOSE AS400-T1 AS400-CD AS200-T1 AS400-R1.
308                 STOP RUN.
```

CROSS REFERENCE LIST

```
0020        AS200-T1      0012  0020
0024        AS400-CD      0017  0024
0026        AS400-R1      0016  0026
0031        AS400-T1      0014  0031
0043        FSORT  0010   0043
0021        KSORT  0011   0021
0179        *ADU-SENS       OF    OUTPU  0169  0169  0169
0174        *ADD-SENS1      OF    OUTPU  0169  0169  0169
0195        *AVB-SENS       OF    OUTPU  0184  0184  0184
0198        *CAL      OF    OUTPU  0196  0196  0196
0273        *CLEAR-ARRAY    OF    MISC   0119  0119  0214  0214  0214
0294        *CLEAR-PH-SENS        OF    MISC   0192  0192  0192  0272  0272  0272
0190        *COMBINE-ALPHAS       OF    OUTPU  0149  0149  0149
0296        *COMBINE-SENS         OF    MISC   0148  0148  0148
0304        *ENQ-RUN        OF    MISC   0108  0148
0202        *FIN      0144  0144  0144
0301        *FINISH-UP      OF    MISC   0127
0209        *FIN-EXIT       OF    FIN    0204  0206  0209  0216
0212        *FOUT     0144  0144  0144
0221        *FOUT-EXIT      OF    FOUT   0219  0221
0212        *FO1      OF    FOUT
0218        *FO2      OF    FOUT   0216  0216  0216
0202        *FS1      OF    FIN
0206        *FS2      OF    FIN    0204  0204  0204
0113        *IN-SEC
0113        *IS1      OF    IN-SE  0147
0127        *IS2      OF    IN-SE  0129  0130  0140
0246        *KIN      0232  0232  0232
0292        *KIN-EXIT       OF    KIN    0248  0252
0295        *KOUT     0232  0232  0232
0262        *KOUT-EXIT      OF    KOUT   0260  0258  0262
0246        *KS1      OF    KIN
0290        *KS2      OF    KIN    0248  0248  0248
0295        *KS3      OF    KOUT
0260        *KS4      OF    KOUT   0298  0298  0298
0265        *MISC
0275        *MISSION-SENSITIVITY        OF    MISC   0184  0184  0184
0143        *OS1      OF    OUTPU
0143        *OUTPUT-SEC     0137  0305  0305  0305
0199        *OUTSEC-EXIT    OF    OUTPU  0199
0098        *PO       OF    SSAAB
0108        *P1       OF    SSAAB  0110  0117  0119
0236        *SCMATCH-DUPS         OF    SORT-  0227  0227  0227
0247        *SET-ARRAY-ENTRY      OF    MISC   0133  0133  0133  0303  0303  0303
0269        *SET-SENS1      OF    MISC   0125  0125  0125
0243        *SKP-EXIT       OF    SORT-  0227  0231  0234  0243
0224        *SKP1     OF    SORT-
0224        *SORT-K-FACTORS       0121  0121  0121  0132  0132  0132
0181        *WRITE-TAPE-REC       OF    OUTPU  0153  0153  0153  0162  0162  0162  0173  0173  0173
0091        ALPHA     OF    WORK-  0128  0132  0139  0191  0185  0209
0094        ALT       OF    WORK-  0122  0136  0161
0074        AN-ALPHAS       OF    ARRAY
0072        ARPS      OF    AR-PH  0174  0177  0179
0267        ARRAY-ENTRY     OF    ARRAY  0190  0193  0207  0219  0248  0273
0066        ARRAY1          OF    WORK1
0069        AR-ALPHA        OF    ARRAY
0075        AR-ALT          OF    ARRAY  0161

0059        AR-ENT          OF    WORK1  0105  0116  0267  0268
0070        AR-KFAC         OF    ARRAY  0160  0170
0073        AR-MISS         OF    ARRAY
0071        AR-PHSENS       OF    ARRAY
0028        AS200-T1        0100  0108  0127  0307
0024        AS400-CD        0099  0307
0026        AS400-R1        0101  0307
0031        AS400-T1        0102  0307
0068        AWUC      OF    ARRAY  0193  0196  0143  0144  0171  0206
0025        CARD1     OF    AS400
0062        CC1       OF    WORK1  0296  0298  0299
0063        CSR       OF    WORK1  0297  0298  0299
0046        FKEY      OF    FSORT  0143
0043        FSORT     0143  0144  0144  0219  0219
0044        FSORT1          OF    FSORT  0207  0207
0097        FT-CNT          OF    WORK1  0103
0033        FT1       OF    AS400  0188  0189
0042        FT2       OF    AS400
0045        F1        OF    FSORT
0035        F1ALPHA         OF    FT1
0036        F1K-FAC         OF    FT1
0039        F1MISS-SENS     OF    FT1
0037        F1PH-SENS       OF    FT1
0038        F1PS      OF    F1PH-
0034        F1WUC     OF    FT1
0040        F1-ALPHAS       OF    FT1
0041        F1-ALT          OF    FT1
0047        F2        OF    FSORT
0065        K         OF    K-ARR  0225  0225  0226  0229  0229  0230  0236  0236  0236  0237  0237  0237
             0238  0238  0238  0239  0239  0239  0240  0240  0240  0241  0241  0241  0289  0290  0260
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0082                KF1    OF   WK-PA
0083                KF2    OF   WK-PA
0084                KF3    OF   WK-PA
0085                KF4    OF   WK-PA
0021                KSORT  0231  0232  0232  0260  0260
0022                KSORT1       OF    KSORT 0290  0290
0023                KS1    OF   KSORT 0231
0064                K-ARRAY      OF    WORK1 0224  0228  0233  0259
0092                K-FAC  OF    WORK- 0121  0133  0134  0180  0171
0094                MISSION-SENS       OF   WORK- 0116  0194  0162  0165  0169  0193  0289
0095                NA     OF    WORK- 0151  0186
0096                NO-ALPHAS    OF    WORK1 0106  0146  0151  0181  0181  0186  0195  0195  0196  0197  0269

0040                OUT-CNT      OF    WORK1 0169  0356
0093                PH-SENS      OF    WORK- 0175  0176  0175  0177  0180  0196  0197  0265  0275  0276  0277
                     0278  0278  0279  0277  0279  0280  0281  0281  0282  0280  0282  0283  0283  0284  0284
                     0284  0286  0286  0287  0287  0287  0289  0291  0292  0294  0296  0293  0299
0027                PRINT-LINE   OF    AS400 0187  0187
0098                PT-CNT       OF    WORK1 0104
0030                REC1   OF    AS200 0109  0116  0128
0090                SPM2   OF    WORK1 0275  0291
0091                SPM8   OF    WORK1 0276  0292
0053                STOP-CNT     OF    WORK1 0147  0301
0054                S1     OF    WORK1 0283  0289  0289  0290
0095                S2     OF    WORK1 0286  0289  0290
                     0160  0161  0163  0166  0170  0175  0176  0177  0179  0192  0202  0204  0202  0206  0207
                     0212  0214  0212  0214  0216  0214  0219  0246  0248  0246  0250  0256  0258  0256
                     0260  0265  0265  0273  0296  0297  0298  0299
0052                TALLY1       OF    WORK1 0152  0156  0158  0171

0061                TLY    OF    WORK1 0164  0165  0164  0167  0169  0167  0175  0176  0176  0177  0174  0179
                     0180  0182  0184  0182  0190  0192  0190  0196  0197  0270  0272  0270  0294
0049                TMP    OF    WORK1
0097                WAIT   OF    WORK- 0122  0136
0081                WK-FAC       OF    WORK- 0120  0121  0131  0133  0134  0224  0228  0233
0076                WORK-REC1    OF    WORK1 0109  0116  0128
0089                WORK-REC2    OF    WORK1 0190  0187  0189  0193  0268
0080                WS1    OF    WORK- 0265  0297
0090                WUC    OF    WORK- 0119  0137
0077                W11    OF    WORK- 0118  0119  0130  0137
0078                W12    OF    WORK- 0110  0117  0125  0129  0132  0135  0269  0302
0079                W13    OF    WORK-
0086                W16    OF    WORK-
ERROR  0299   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0299   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0297   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0296   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0273   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0265   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0265   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0260   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0250   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0250   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0219   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0207   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0206   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0193   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0186   NUMERIC MOVE MAY RESULT IN LEFT TRUNCATION
ERROR  0186         AND/OR OVERFLOW INTO FILLER.
ERROR  0179   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0177   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0177   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0177   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0172   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0167   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0163   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0161   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0161   SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0158   NO ON SIZE ERROR, OVERFLOW POSSIBLE
ERROR  0151   NUMERIC MOVE MAY RESULT IN LEFT TRUNCATION
ERROR  0151         AND/OR OVERFLOW INTO FILLER.

COBOL COMPILATION TIME       8 SECONDS.
```

PROGRAM: AS500A

Input: AS400-T1
AS500-CD

Output: AS500-R1
AS500-D1

Purpose: This is a formatted dump of the combined path/sensitivity tape generated in AS400A. Output can be a printout of combined paths and/or a deck of cards with WUC versus flight-phase sensitivity. Output is controlled by the control card AS500-CD.

```
19:19:56    OOUR COB AS500A,AS500A
 UEC COBOL VERSION 3.0L4
COMPILED ON -  17 JAN 78 AT 19:19:56
           1                    IDENTIFICATION DIVISION.
           2                    PROGRAM-ID.     AS500A.
           3                    AUTHOR. ROBT RITTER.
           4                    REMARKS.        PRINT-COMBINED PATH SENSITIVITY.
           5                    ENVIRONMENT DIVISION.
           6                    CONFIGURATION SECTION.
           7                    SOURCE-COMPUTER. UNIVAC-1100.
           8                    OBJECT-COMPUTER. UNIVAC-1100.
           9                    INPUT-OUTPUT SECTION.
          10                    FILE-CONTROL.
          11                        SELECT AS500-CD ASSIGN TO CARD-READER-EIGHTY.
          12                        SELECT AS500-D1   ASSIGN TO CARD-PUNCH-EIGHTY.
          13                        SELECT AS500-R1 ASSIGN TO PRINTER.
          14                        SELECT AS400-T1 ASSIGN TO UNISERVO N
          15                            RESERVE 4 ALTERNATE AREAS.
          16                    DATA DIVISION.
          17                    FILE SECTION.
          18                    FD AS500-CD LABEL RECORD OMITTED DATA RECORD CARD1.
          19                    01 CARD1 PIC X(80).
          20                    FD AS500-D1   LABEL RECORD OMITTED DATA RECORD PCH-LINE.
          21                    01 PCH-LINE.
          22                        02 PL11 PICTURE X(60).
          23    11 2                02 PL2 PICTURE X(12).
          24                    FD AS500-R1 LABEL RECORD OMITTED DATA RECORD PRINT-LINE.
          25                    01 PRINT-LINE PICTURE X(132).
          26                    FD AS400-T1 LABEL RECORD OMITTED DATA RECORDS FT1 FT2
          27                        BLOCK CONTAINS 90 RECORDS.
          28                    01 FT1.
          29                        02 F1WUC PICTURE X(7).
          30     1 1                02 F1ALPHA PICTURE X(Y).
          31     2 2                02 F1K-FAC PICTURE XXXX.
          32     3 0                02 F1PH-SENS.
          33     3 0                    03 F1PS PICTURE 9V9(3) OCCURS 9 TIMES.
          34     9 0                02 F1MISS-SENS PICTURE 9V9(3).
          35     9 4                02 F1-ALPHAS PICTURE 99.
          36    10 0                02 F1-ALT      PIC X(8).
          37                    01 FT2 PICTURE X(60).
          38                    WORKING-STORAGE SECTION.
          39                    77 ENT-CNT PICTURE 99999.
          40     1 0            77 LINE-CNT PICTURE 99999.
          41     2 0            01 PL1.
          42     2 0                02 WUC PICTURE XXXXXX$$B.
          43     3 4                02 K-FAC PICTURE XXXX$$B.
          44     4 5                02 PH-SENS OCCURS 9 TIMES PICTURE 9.9999B.
          45    15 2                 02  CB  PIC X(11).
          46    17 1                02 NA PICTURE $$999B.
          47    18 1                02 ALT      PIC X(8).
          48    20 0            01 HEAD1.
          49    20 0                02 H11 PICTURE X(31) VALUE '                    ----------'.
          50    29 1                02 H12 PICTURE X(33) VALUE
          51    29 1                    'TOTAL SENSITIVITY BY FLIGHT PHASE'.
          52    30 4                02 H13 PICTURE X(31) VALUE
          53    30 4                    '----------                NO.'.
          54    36 0            01 HEAD2.
          55    36 0                02 H21 PICTURE X(33) VALUE
          56    36 0                    ' WUC      K-FAC   PH1    PH2    P'.
          57    41 3                02 H22 PICTURE X(28) VALUE 'H3    PH4    PH5    PH6    P'.
          58    46 1                02 H23 PICTURE X(30) VALUE 'H7    PH8    PH9              '.
          59    51 1                02 H24 PICTURE X(10) VALUE 'ALPHAS ALT'.
          60                    PROCEDURE DIVISION.
          61                    P0.
          62                        MOVE 0 TO ENT-CNT.
          63                        MOVE 0 TO LINE-CNT.
          64                        OPEN INPUT AS400-T1.
          65                        OPEN OUTPUT AS500-R1.
          66                        OPEN OUTPUT AS500-D1.
          67                        OPEN INPUT AS500-CD.
          68                        PERFORM HEAD-LINES.
          69                    P1.
          70                        READ AS400-T1 AT END GO TO END-RUN.
          71                        IF F1WUC LESS THAN 'ZZZZZZZ' GO TO P1.
          72                        MOVE SPACE TO PCH-LINE.
          73                        MOVE FT2 TO PL11.
          74                        MOVE SPACE TO PL2.
          75                        WRITE PCH-LINE.
          76                        ADD 1 TO ENT-CNT.
          77                        PERFORM MOVE-AND-PRINT.
          78                        GO TO P1.
          79                    P5.
          80                        PERFORM PAGE-BREAK.
          81                        PERFORM HEAD-LINES.
          82                        PERFORM MOVE-AND-PRINT.
          83                        GO TO P6.
          84                    PAGE-BREAK.
          85                        MOVE SPACE TO PRINT-LINE.
          86                        WRITE PRINT-LINE AFTER ADVANCING 99 LINES.
          87                        WRITE PRINT-LINE AFTER ADVANCING 99 LINES.
```

```
                    P6.
                        READ     AS400-T1 AT END GO TO END-RUN.
                        PERFORM MOVE-AND-PRINT.
                        GO TO P6.
                    MOVE-AND-PRINT.
                        MOVE F1WUC TO WUC.
                        MOVE F1K-FAC TO K-FAC.
                        PERFORM SENS-MOVE VARYING TALLY FROM 1 BY 1 UNTIL TALLY
                        GREATER THAN 9.
                        MOVE SPACE TO CS.
                        MOVE F1-ALPHAS TO NA.
                        MOVE F1-ALT TO ALT.
                        ADD 1 TO LINE-CNT.
                        IF LINE-CNT GREATER THAN 48 PERFORM HEAD-LINES.
                        WRITE PRINT-LINE FROM PL1.
                    SENS-MOVE.
                        MOVE F1PS(TALLY) TO PH-SENS(TALLY).
                    HEAD-LINES.
                        MOVE SPACE TO PRINT-LINE.
                        WRITE PRINT-LINE AFTER ADVANCING 59 LINES.
                        WRITE PRINT-LINE.
                        WRITE PRINT-LINE FROM HEAD1.
                        WRITE PRINT-LINE FROM HEAD2.
                        MOVE SPACE TO PRINT-LINE.
                        WRITE PRINT-LINE.
                        MOVE 5 TO LINE-CNT.
                    END-RUN.
                        MOVE SPACE TO PRINT-LINE.
                        WRITE PRINT-LINE AFTER ADVANCING 59 LINES.
                        CLOSE AS400-T1 WITH LOCK.
                        CLOSE AS500-CO AS500-R1  AS500-D1.
                        MONITOR ENT-CNT.
                        STOP RUN.
```

C R O S S R E F E R E N C E L I S T

```
0026                AS400-T1      0014  0026
0018                AS900-CO      0011  0018
0020                AS900-D1      0012  0020
0024                AS900-R1      0013  0024
0115               *END-RUN       OF    $$AAB  0070  0089
0106               *HEAD-LINES    OF    $$AAB  0069  0069  0069  0082  0082  0082  0101  0101  0101
0093               *MOVE-AND-PRINT     OF    $$AAB  0077  0077  0077  0082  0082  0082  0090  0090  0090
0085               *PAGE-BREAK    OF    $$AAB  0081  0081  0081
0061               *P0       OF    $$AAB
0070               *P1       OF    $$AAB  0071  0078
0080               *P5       OF    $$AAB
0089               *P6       OF    $$AAB  0083  0091
0104               *SENS-MOVE     OF    $$AAB  0097  0097  0097
0047                ALT      OF    PL1    0100
0026                AS400-T1      0064  0070  0089  0118
0018                AS900-CO      0067  0118
0020                AS900-D1      0066  0118
0024                AS900-R1      0065  0118
0019                CAND1    OF    AS900
0045                CS       OF    PL1    0097
0039                ENT-CNT       OF    WORK1  0062  0076  0119
0028                FT1      OF    AS400
0037                FT2      OF    AS400  0073
0030                F1ALPHA       OF    FT1
0031                F1K-FAC       OF    FT1    0094
0034                F1HISR-SENS   OF    FT1
0032                F1PH-SENS     OF    FT1
0033                F1PS     OF    F1PH-  0104
0029                F1WUC    OF    FT1    0071  0093
0035                F1-ALPHAS     OF    FT1    0098
0036                F1-ALT        OF    FT1    0100
0048                HEAD1    OF    WORK1  0109
0054                HEAD2    OF    WORK1  0110
0049                H11      OF    HEAD1
0050                H12      OF    HEAD1
0052                H13      OF    HEAD1
0055                H21      OF    HEAD2
0057                H22      OF    HEAD2
0058                H23      OF    HEAD2
0059                H24      OF    HEAD2
0043                K-FAC    OF    PL1    0094
0040                LINE-CNT      OF    WORK1  0064  0100  0101  0114
0046                NA       OF    PL1    0098
0021                PCH-LINE      OF    AS900  0072  0075
0044                PH-SENS       OF    PL1    0104
0041                PL1      OF    WORK1  0102
0022                PL11     OF    PCH-L  0073
0023                PL2      OF    PCH-L  0074
0025                PRINT-LINE    OF    AS900  0064  0064  0087  0102  0102  0107  0107  0108  0109  0109  0110
                     0110  0112  0112  0116  0116
0042                WUC      OF    PL1    0093
ERROR  0104        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR  0104        SIGN PRESENT ON FIELD SHOULD BE POSITIVE

COBOL COMPILATION TIME       2 SECONDS.
```

PROGRAM: AS600A

Inputs: AS400-T1 (Combined path tape)
AS500-C1 (Failure data)

Output: AS600-T1 (Combined path and failure data)

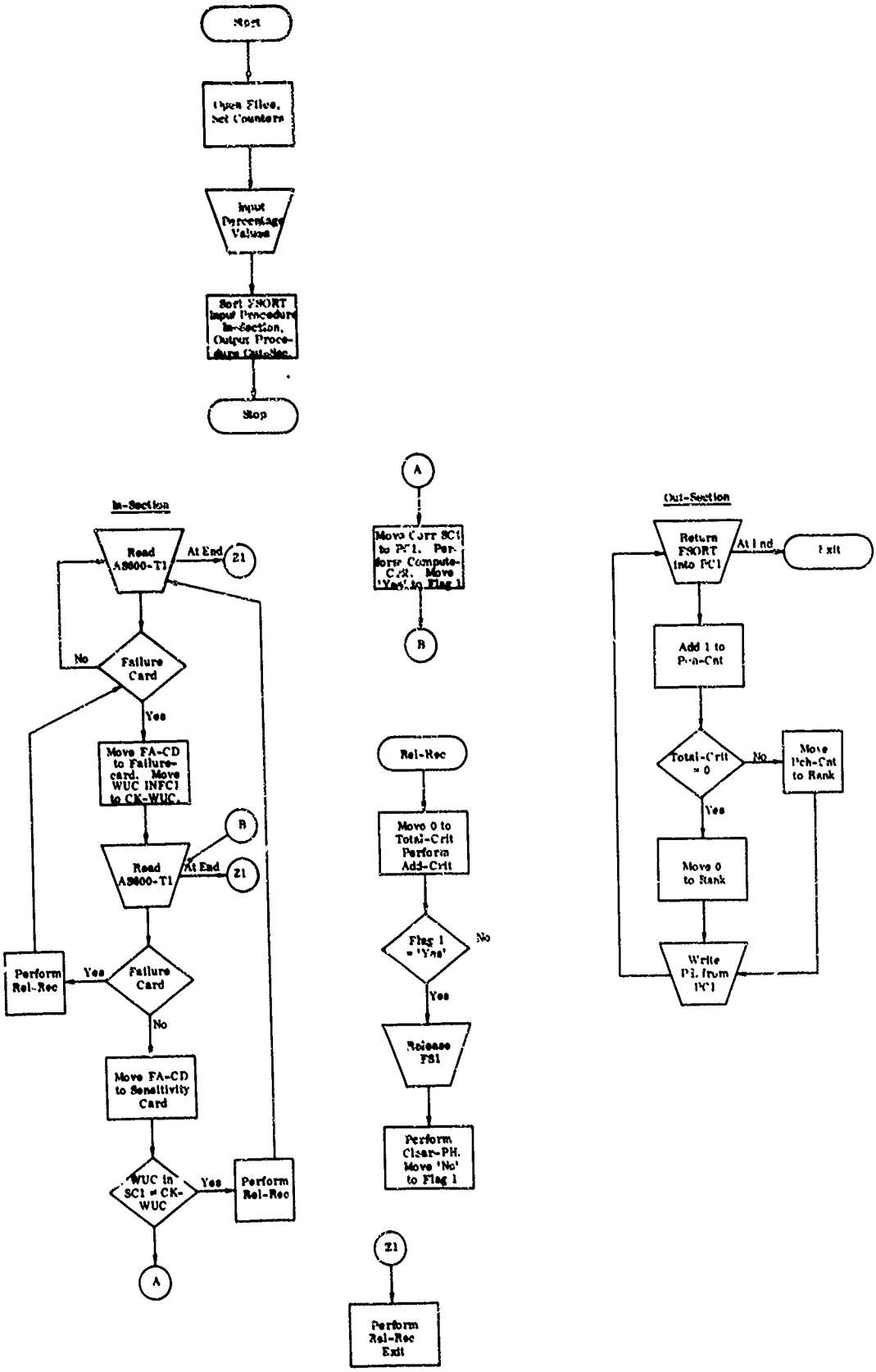
Purpose: In preparation for the criticality calculation turn that follows, the combined path data is merged with a deck of failure rate cards.

```
1n2:n:49    GHUR COR AS.UUA.AS60.A
UCC COBOL TEST COMPILER
COMPILED ON -  31 JAN 7. AT 1o:n.:49
              IDENTIFICATION DIVISION.
              PROGRAM-ID.     AS600A.
              AUTHOR. ROBT RITTER.
              REMARKS.        SORT COMBINED PATH TAPE MERGING WITH FAILURE
                              DATA FROM CARDS.
              ENVIRONMENT DIVISION.
              CONFIGURATION SECTION.
              SOURCE-COMPUTER. UNIVAC-1108.
              OBJECT-COMPUTER. UNIVAC-1108.
              INPUT-OUTPUT SECTION.
              FILE-CONTROL.
                  SELECT AS600-CD ASSIGN TO CARD-READER-EIGHTY.
                  SELECT AS400-T1 ASSIGN TO UNISERVO H
                      RESERVE 2 ALTERNATE AREAS.
                  SELECT AS600-R1 ASSIGN TO PRINTER.
                  SELECT AS600-T1 ASSIGN TO UNISERVO F
                      RESERVE 2 ALTERNATE AREAS.
                  SELECT FSORT ASSIGN TO DRUM 1500000 WORDS.
              DATA DIVISION.
              FILE SECTION.
              FD  AS400-T1   LABEL RECORD OMITTED DATA RECORD TR2
                      BLOCK CONTAINS 40 RECORDS.
              01  TR2.
                  02  WUC          PIC X(7).
1 1               02  FILLER         PIC X(61).
              FD AS600-CD LABEL RECORD OMITTED DATA RECORD CARD1.
              01 CARD1.
                  02 C4 PICTURE XXXX.
0 4               02 FILLER PICTURE XXXXX.
1 3               02 C5 PICTURE XXXXXXX.
2 4               02 FILLER PICTURE XXXXX.
3 3               02 C7 PICTURE XXXX.
4 1               02 FILLER PICTURE X(53).
13 0              02 C9 PICTURE XX.
              FD  AS600-T1 LABEL RECORD OMITTED DATA RECORD REC1
                      BLOCK CONTAINS 40 RECORDS.
              01  REC1   PIC  X(98).
              FD  AS600-R1 LABEL RECORD OMITTED DATA RECORD PRINT-LINE.
              01 PRINT-LINE PICTURE X(132).
              SD  FSORT FILE CONTAINS ABOUT 60000 RECORDS DATA RECORD FSORT1.
              01  FSORT1.
                  02  SKEY1  PIC X(14).
2 2               02  SKEY2   PIC XXXX.
3 0               02 FS1  PIC X(80).
3 0           WORKING-STORAGE SECTION.
              77 REC-CNT PICTURE 99999.
1 0           77 P-CNT PICTURE 99.
2 0           77 T-CNT PICTURE 99999999.
2 0           PROCEDURE DIVISION.
              P0.
                  OPEN INPUT AS600-CD.
                  OPEN OUTPUT AS600-T1.
                  OPEN INPUT AS400-T1.
                  OPEN OUTPUT AS600-R1.
                  MOVE 0 TO REC-CNT.
                  MOVE 0 TO P-CNT.
                  MOVE 0 TO T-CNT.
                  SORT    FSORT ON DESCENDING KEY SKEY1 SKEY2 INPUT PROCEDURE
                              IS
                        IN-SEC OUTPUT PROCEDURE IS OUT-SEC.
                  MONITOR REC1.
                  CLOSE AS600-T1 AS600-CD AS600-R1 AS400-T1.
                  MONITOR REC-CNT.
                  STOP RUN.
              IN-SEC SECTION.
              IS1.
                  ADD 1 TO REC-CNT.
                  MOVE SPACE TO FSORT1.
                  READ AS600-CD AT END GO TO READ-TAPE.
                  MOVE C5 TO SKEY1.
                  MOVE C4 TO SKEY2.
                  MOVE CARD1 TO FS1.
                  RELEASE FSORT1.
                  GO TO IS1.
              READ-TAPE.
                  READ AS400-T1   AT END GO TO IS-EXIT.
                  MOVE WUC TO SKEY1.
                  MOVE SPACE TO SKEY2.
                  MOVE   TR2 TO FS1.
                  RELEASE FSORT1.
                  ADD 1 TO T-CNT.
                  ADD 1 TO REC-CNT.
                  GO TO READ-TAPE.
              IS-EXIT.
                  EXIT.
              OUT-SEC SECTION.
              OS1.
                  RETURN FSORT RECORD AT END GO TO OS-EXIT.
                  MOVE FSORT1 TO REC1.
                  WRITE REC1.
                  ADD 1 TO P-CNT.
                  IF P-CNT LESS THAN 5
                  WRITE PRINT-LINE FROM FSORT1.
                  GO TO OS1.
              OS-EXIT.
                  EXIT.
```

CROSS REFERENCE LIST

0021	AS400-T1	0013	0021						
0026	AS600-CD	0012	0026						
003R	AS600-R1	0015	003R						
0035	AS600-T1	0016	0035						
0040	FSORT 0018	0040							
0067	*IN-SEC	0060	0060	0060					
0085	*IS-EXIT	OF	IN-SE	0077	0085				
0067	*IS1 OF	IN-SE	0074						
0096	*OS-EXIT	OF	OUT-S	0088	0096				
0088	*OS1 OF	OUT-S	0094						
008A	*OUT-SEC	0060	0060	0060					
0050	*P0 OF	*BAAB							
0076	*READ-TAPE	OF	IN-SE	0070	0083				
0021	AS400-T1	0053	0062	0076					
0026	AS600-CD	0051	0062	0069					
003R	AS600-R1	0054	0062						
0035	AS600-T1	0052	0062						
0027	CARD1 OF	AS600	0072						
0028	C4 OF	CARD1	0071						
0030	C5 OF	CARD1	0070						
0032	C7 OF	CARD1							
0034	C9 OF	CARD1							
0040	FSORT 0058	0060	0060	008A					
0041	FSORT1	OF	FSORT	0068	0073	0080	0089	0093	
0044	FS1 OF	FSORT	0072	0079					
0039	PRINT-LINE	OF	AS600	0093	0093				
0047	P-CNT OF	WORKI	0056	0091	0093				
0046	REC-CNT	OF	WORKI	0055	0063	0067	0082		
0037	REC1 OF	AS600	0062	0089	0090				
0042	SKEY1 OF	FSORT	0058	0070	0077				
0043	SKEY2 OF	FSORT	0058	0071	0078				
0023	TR2 OF	AS400	0079						
0048	T-CNT OF	WORKI	0057	0081					
0024	WUC OF	TR2	0077						

COBOL COMPILATION TIME 3 SECONDS.


Start
Open Files, Set Counters
Input Percentage Values
Sort FSORT Input Procedure In-Section, Output Procedure Out-Sec.
Stop
In-Section
Read AS600-T1
At End
Z1
No
Failure Card
Yes
Move FA-CD to Failure-card. Move WUC INFC1 to CK-WUC.
B
Read AS600-T1
At End
Z1
Perform Rel-Rec
Yes
Failure Card
No
Move FA-CD to Sensitivity Card
WUC in SC1 = CK-WUC
Yes
Perform Rel-Rec
A
A
Move Corr SC1 to PC1. Perform Compute-Crit. Move 'Yes' to Flag 1
B
Rel-Rec
Move 0 to Total-Crit Perform Add-Crit
Flag 1 = 'Yes'
No
Yes
Release FS1
Perform Clear-PH. Move 'No' to Flag 1
Z1
Perform Rel-Rec Exit
Out-Section
Return FSORT into PC1
At End
Exit
Add 1 to P-n-Cnt
Total-Crit = 0
No
Move Pch-Cnt to Rank
Yes
Move 0 to Rank
Write Pi. from PC1

PROGRAM: AS700A

Inputs: AS600-T1 (Merged path and failure)
AS100-T1 (Dictionary tape)

Outputs: AS700-R1 (Printout of prelim. & total crit)
AS700-D1 (Deck of criticality cards)

Purpose: Computes criticality from WUC sensitivity and failure rate data, provides a listing and punchcard deck of criticality by phase for each WUC.

(See illustration on opposite page.)

```
16:56:35    @BUC COM AS700A,AS700A
UCC COBOL TEST COMPILER
COMPILED ON -  01 FEB 7C AT 16:56:35
                1                   IDENTIFICATION DIVISION.
                2                   PROGRAM-ID.
                3                           AS700A.
                4                   AUTHOR.     R RITTER.
                5                   REMARKS.
                6                           CALCULATE CRITICALITIES.
                7                   ENVIRONMENT DIVISION.
                8                   CONFIGURATION SECTION.
                9                   OBJECT-COMPUTER.
               10                           UNIVAC-1100.
               11                   SOURCE-COMPUTER.
               12                           UNIVAC-1100.
               13                   INPUT-OUTPUT SECTION.
               14                   FILE-CONTROL.
               15                       SELECT ASACO-T1 ASSIGN TO UNISERVO 5.
               16                       SELECT AS700-A1 ASSIGN TO PRINTER.
               17                       SELECT AS700-01 ASSIGN TO CARD-PUNCH-EIGHTY.
               18                       SELECT AS700-CD ASSIGN TO CARD-READER-EIGHTY.
               19                       SELECT FSORT  ASSIGN TO DRUM 40000 WORDS.
               20                   DATA DIVISION.
               21                   FILE SECTION.
               22                   FD ASACO-T1
               23                           RECORD CONTAINS 80 CHARACTERS
               24                           BLOCK CONTAINS 40 RECORDS
               25                           LABEL RECORDS OMITTED
               26                           DATA RECORD FILEA.
               27                   01  FILEA.
               28                       02  FA-SORT-KEY          PICTURE X(14).
          2    29                       02  FA-ID                PICTURE XXXX.
          3    30                       02  FA-CD                PICTURE X(80).
               31                   FD  AS700-A1
               32                           RECORD CONTAINS 132 CHARACTERS
               33                           LABEL RECORD OMITTED
               34                           DATA RECORD PL.
               35                   01  PL                       PICTURE X(132).
               36                   FD  AS700-01
               37                           RECORD CONTAINS 80 CHARACTERS
               38                           LABEL RECORD OMITTED
               39                           DATA RECORD FILEC.
               40                   01  FILEC                    PICTURE X(80).
               41                   FD  AS700-CD
               42                           RECORD CONTAINS 80 CHARACTERS
               43                           LABEL RECORD OMITTED
               44                           DATA RECORD IS PERCENTAGE-CARDS.
               45                   01  PERCENTAGE-CARDS.
               46                       02  PCDS1                PICTURE X(54).
          0    47                       02  FILLER               PICTURE X(26).
               48                   SD  FSORT
               49                           FILE CONTAINS ABOUT 2500 RECORDS
               50                           DATA RECORD IS FS1.
               51                   01  FS1.
               52                       02  FILLER               PICTURE X(60).
          11   53                       02  SKEY                 PICTURE 9V999999.
          12   54                       02  FILLER               PICTURE X(6).
          14   55                   WORKING-STORAGE SECTION.
               56                   77  COMP1                    PIC 9V999999.
          1    57                   77  FLAG1                    PIC XXX VALUE 'NO'.
          2    58                   77  E     PIC 9V999999  VALUE 2.718282.
          3    59                   77  LINE-CNT                 PICTURE 999.
          4    60                   77  PCH-CNT                  PICTURE 9(5).
          5    61                   77  SPACER                   PICTURE X VALUE ' '.
          6    62                   77  CN-MUC                   PICTURE X(7).
          8    63                   77  P-IND                    PICTURE 99.
          9    64                   77  X                        PICTURE 99.
         10    65                   01  CONTROL-CARD.
         10    66                       02  CC-ID                PICTURE X(10).
         11    67                       02  FLIGHTS              PICTURE 9(5).
         12    68                       02  FILLER               PICTURE X(65).
         24    69                   01  TWOC.
         24    70                       02  T-OC1                PICTURE XX.
         24    71                       02  T-OC2                PICTURE X(5).
         26    72                   01  PERCENT-SET-ARRAY.
         26    73                       02  FILLER               PICTURE X(30) VALUE
                                           '111213142329041424445464749515961'.
         26    74                       02  FILLER               PICTURE X(24) VALUE
         31    75                           '47414364465674871787383961'.
         31    76                   01  XS1   REDEFINES PERCENT-SET-ARRAY.
         26    77                       02  X1                   PICTURE 9X OCCURS 27 TIMES.
         26    78                   01  X-INDEX.
         35    79                       02  FILLER               PICTURE X(30) VALUE
         35    80                           '010203040608070809101110121314'.
         35    81                       02  FILLER               PICTURE X(24) VALUE
         40    82                           '151515161713181919030?'.
         40    83                   01  XS2 REDEFINES  X-INDEX.
         35    84                       02  X2                   PICTURE 99 OCCURS 27 TIMES.
         35    85                   01  SENSITIVITY-CARD.
         44    86                       02  SC1.
         44    87                           03  MUC              PICTURE X(7).
         44    88                           03  ALPHA            PICTURE X(7).
         45    89                           03  X-FAC            PICTURE XXXX.
         46    90                           03  PM-SENS.
         47    91                               04 P01           PICTURE 9V999 OCCURS 9 TIMES.
         47    92                           03  MISS-SENS        PICTURE 9V999.
         53    93                           03  VALPHAS          PICTURE 99.
         53    94                           03  ALT              PICTURE X(4).
         54    95                   01  PUNCH-CARD.
         56    96
```

```
 97    90 3              02  PC1.
 98    94 3                  05  WUC             PICTURE X(7).
 99    97 1                  05  ALPHA           PICTURE X(7).
100    98 2                  05  PW-CRIT.
101    98 2                      06  PC          PICTURE  9V99999 OCCURS 9 TIMES.
102    67 2                05  TOTAL-CRIT     PICTURE 9V99999.
103    68 2                05  RANK            PICTURE 9(6).
104    70 5          01  PERCENTAGE-ARRAY.
105    70 3              02  PA1 OCCURS 23 TIMES.
106    70 5                  05  PA11 OCCURS 9 TIMES.
107    70 5                      06  PA2             PICTURE 9V9999.
108    70 5                      06 FILLER           PICTURE X.
109   250 3          01  FAILURE-CARD.
110   250 0              02  FC1.
111   250 3                  05  FC-ID           PICTURE XXXX.
112   250 4                  05  FILLER          PICTURE X(5).
113   251 5                  05  WUC             PICTURE X(7).
114   252 4                  02  FILLER          PICTURE X(6).
115   253 4                  02  WF              PICTURE 999.
116   253 4                  02  XC-REDEF REDEFINES WF  PIC XXX.
117   254 1                  02  FILLER          PICTURE X(95).
118   254 1          PROCEDURE DIVISION.
119                   P0.
120                       OPEN      INPUT AS400-T1.
121                       OPEN      INPUT AS700-CD.
122                       READ      AS700-CD INTO CONTROL-CARD AT END STOP RUN.
123                       OPEN      OUTPUT AS700-R1.
124                       OPEN      OUTPUT AS700-D1.
125                       PERFORM CLEAR-PW.
126                       PERFORM PERCENTAGE-INPUT VARYING TALLY FROM 1 BY 1 UNTIL
127                                 TALLY EQUAL 21.
128                       SORT      FSORT ON  DESCENDING KEY  SKEY
129                                 INPUT PROCEDURE IS IP-SECTION
130                                 OUTPUT PROCEDURE IS OUT-SECTION.
131                       GO  TO    END-RUN.
132                   IN-SECTION  SECTION.
133                   IS1.
134                       READ      AS400-T1 AT END GO TO IN-EXIT.
135                   IS2.
136                       IF        FA-ID = 'AFPH' MOVE FA-CD TO FAILURE-CARD
137                                 ELSE GO TO IS1.
138                       MOVE      WUC IN FC1 TO CK-WUC.
139                   IS3.
140                       READ      AS400-T1 AT END GO TO IN-EXIT.
141                       IF        FA-ID = 'AFPH'
142                                 PERFORM REL-REC
143                                 GO TO IS2.
144                       MOVE      FA-CD TO SENSITIVITY-CARD.
145                       IF        K-FAC IN SC1 NOT EQUAL '   '
146                                 PERFORM ZERO-SENS VARYING TALLY FROM 1 BY 1
147                                 UNTIL TALLY GREATER THAN 3.
148                       IF        WUC IN SC1 NOT EQUAL CK-WUC
149                                 PERFORM REL-REC
150                                 GO TO IS1.
151
CO-RSP      MOVE THE FOLLOWING ITEMS TO   CORRESPONDING ITEMS IN   PC1
                WUC
                ALPHA
152                       MOVE      CORRESPONDING  SC1 TO PC1.
153                       PERFORM  PERCENT-SET.
154                       EXAMINE WF-REDEF REPLACING ALL ' ' BY '0'.
155                       PERFORM COMPUTE-CRIT VARYING TALLY FROM 1 BY 1 UNTIL
156                                 TALLY = 10.
157                       MOVE 'YES' TO FLAG1.
158                       GO TO   IS3.
159                   IN-EXIT.
160                       PERFORM REL-REC.
161                   OUT-SECTION SECTION.
162                   OS1.
163                       MOVE      0 TO PCH-CNT.
164                   OS2.
165                       RETURN    FSORT RECORD INTO PC1 AT END GO TO OS-EXIT.
166                       ADD       1 TO PCH-CNT.
167                       IF        TOTAL-CRIT IN PC1 EQUAL 0 MOVE 0 TO
168                                 RANK IN PC1
169                                 ELSE MOVE PCH-CNT TO RANK IN PC1.
170                       WRITE     FILEC FROM PC1.
171                       WRITE     P1 FROM PC1.
172                       GO TO     OS2.
173                   OS-EXIT.
174                       EXIT.
175                   MISC SECTION.
176                   ADD-CRIT.
177                       ADD       PC(TALLY) TO TOTAL-CRIT.
178                   COMPUTE-CRIT.
179                       COMPUTE COMP1 ROUNDED = (1 - P ** (NF / FLIGHTS * -1))
180                                 * PS1(TALLY) * PA2(X, TALLY)
181                                 ON SIZE ERROR MOVE 0 TO COMP1.
182                       COMPUTE PC(TALLY) ROUNDED = PC(TALLY) + COMP1 +
183                                 PC(TALLY) * COMP1 ON SIZE ERROR MONITOR COMP1.
184                   PERCENT-SET.
185                       MOVE      20 TO X.
186                       MOVE      WUC IN PC1 TO TWUC.
187                       PERFORM PS1 VARYING TALLY FROM 1 BY 1 UNTIL TALLY = 28.
188                       MOVE      X2(X) TO X.
189                       MONITOR X.
190                   PS1.
191                       IF        TWUC1 = X1(TALLY)
192                                 MOVE TALLY TO X
193                                 MOVE 27 TO TALLY.
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                193                 PERCENTAGE-INPUT.
                194                     READ      AS700-CD AT END MOVE 1Y TO TALLY.
                195                     MOVE      PCD81  TO PA1(TALLY).
                196                     WRITE PL FROM PA1(TALLY).
                197                 CLEAR-PH.
                198                     MOVE    ALL '0' TO PH-CRIT.
                199                 ACCUMULATE.
                200                     MOVE    0 TO TOTAL-CRIT IN PC1.
                201                     PERFORM ADD-CRIT VARYING TALLY FROM 1 BY 1 UNTIL TALLY = 10.
                202                     IF FLAG1 = 'YES' RELEASE PS1 FROM PC1.
                203                     PERFORM CLEAR-PH.
                204                     MOVE    'NO' TO FLAG1.
                205                 CHECK-SENS.
                206                     MOVE    0 TO PS1(TALLY).
                207                 END-RUN.
                208                     CLOSE     AS400-T1 WITH LOCK.
                209                     CLOSE     AS700-R1.
                210                     CLOSE     AS700-D1, AS700-CD
                211                     MONITOR   PCM-CNT.
                212                     STOP RUN.
ERROR   0204        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR   0197        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR   0195        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR   0192        ARITHMETIC MOVE MAY RESULT IN LEFT TRUNCATION
ERROR   0192          AND/OR OVERFLOW INTO FILLER.
ERROR   0191        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR   0182        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR   0182        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR   0192        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR   0182        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR   0182        SIGN PRESENT ON FIELD SHOULD BE POSITIVE
ERROR   0174        SIGN PRESENT ON FIELD SHOULD BE POSITIVE

COBOL COMPILATION TIME       5 SECONDS.
```

APPENDIX C

DERIVATION OF BASIC SENSITIVITY EQUATIONS

CONTENTS, APPENDIX C

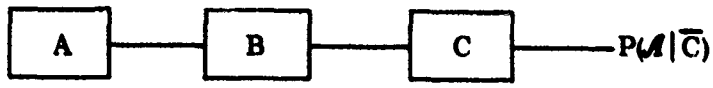
APPENDIX C

This appendix gives the derivation of the basic element-sensitivity models presented in Section 4.4.4. Also included is a numerical example for a design which includes the major cases considered.

Certain terms are basic to the following equations. The letters A, B, C will represent properly operating mission functions; $\overline{A}$, $\overline{B}$, etc., nonoperating functions; the symbol $\mathcal{A}$, an accident; and i_a, i_b, etc., the i^{th} element of function A, B, etc. The term $P(\overline{B}|\overline{A})$ is the probability that function B is unobtainable, given that function A is not performed.

C.1 SERIES RELATIONSHIP MODEL

For functions in series:

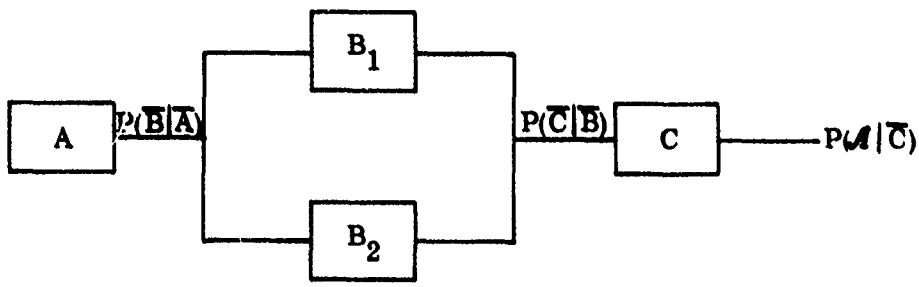


The probability of an accident given failure of the i^{th} Work Unit Code elements is given by:

$$\begin{aligned} P(\mathcal{A}|i_a) &= P(\overline{C}|i_a)\,P(\mathcal{A}|\overline{C}) \\ &= P(\overline{B}|i_a)\,P(\overline{C}|\overline{B})\,P(\mathcal{A}|\overline{C}) \\ &= P(\overline{A}|i_a)\,P(\overline{B}|\overline{A})\,P(\overline{C}|\overline{B})\,P(\mathcal{A}|\overline{C}) \end{aligned} \qquad \text{(C-1)}$$

Note that in the development of this equation we start first with the highest level function (C) for which it is assumed that $P(\mathcal{A}|\overline{C})$ is known; and relate the state of C to the state of A (given i_a fails) through the link dependencies.

C.2 FUNCTIONAL REDUNDANCY



The term $\overline{B}$ will denote the state in which B_1 and B_2 are both failed ($\overline{B}_1\overline{B}_2$).

For an element in A:

$$P(\mathcal{A}|i_a) = P(\overline{C}|i_a)P(\mathcal{A}|\overline{C})$$

$$= P(\overline{B}|i_a)P(\overline{C}|\overline{B})P(\mathcal{A}|\overline{C})$$

$$= P(\overline{A}|i_a)P(\overline{B}|\overline{A})P(\overline{C}|\overline{B})P(\mathcal{A}|\overline{C}). \quad \text{(C-2)}$$

For an element in B (say in B_1):

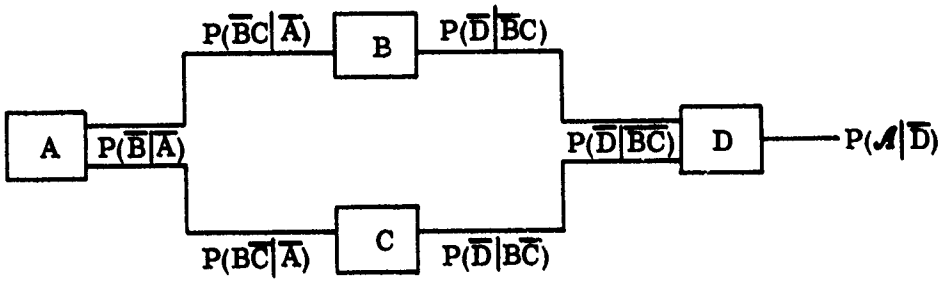
$$P(\mathcal{A}|i_{b_1}) = P(\overline{C}|i_{b_1})P(\mathcal{A}|\overline{C})$$

$$= P(\overline{B}|i_{b_1})P(\overline{C}|\overline{B})P(\mathcal{A}|\overline{C})$$

$$= P(\overline{B}_1|i_{b_1})P(\overline{B_2})P(\overline{C}|\overline{B})P(\mathcal{A}|\overline{C}). \quad \text{(C-3)}$$

Note that we have assumed that C requires either B_1 or B_2, which are equally effective in providing an input to C. If this were not true, the relationship would be one of parallel functions.

C.3 PARALLEL FUNCTIONS



For an element in A:

$$P(\mathcal{A}|i_a) = P(\overline{D}|i_a)P(\mathcal{A}|\overline{D})$$

$$= \{P(\overline{B}C|i_a)P(\overline{D}|\overline{B}C) + P(B\overline{C}|i_a)P(\overline{D}|B\overline{C}) + P(\overline{BC}|\overline{A})P(\overline{D}|\overline{BC})\}\, P(\mathcal{A}|\overline{D})$$

$$= P(\overline{A}|i_a)\ \{P(\overline{B}C|\overline{A})P(\overline{D}|\overline{B}C) + P(B\overline{C}|\overline{A})P(\overline{D}|B\overline{C})$$

$$+ P(\overline{BC}|\overline{A})P(\overline{D}|\overline{BC})\}\, P(\mathcal{A}|\overline{D}) \quad \text{(C-4)}$$

For an element in B,

$$P(\mathcal{A}|i_b) = P(\overline{D}|i_b)P(\mathcal{A}|\overline{D})$$

$$= P(\overline{B}|i_b)P(\overline{D}|\overline{B})P(\mathcal{A}|\overline{D})$$

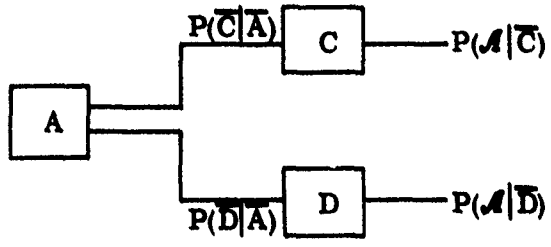
$$= P(\overline{B}|i_b)\{P(\overline{C}|i_b)P(\overline{D}|\overline{BC})$$

$$+ P(C|i_b)P(\overline{D}|\overline{BC})\}P(\mathcal{A}|\overline{D}) \qquad \text{(C-5)}$$

Note that for an element in B we consider the two conditional probabilities $P(\overline{C}|i_b)$ and $P(C|i_b)$ to account for the possibility of load sharing between B and C. If there is independence between B and C in the reliability sense, we have

$$P(\overline{C}|i_b) = P(\overline{C}) \text{ and } P(C|i_b) = 1 - P(\overline{C}|i_b) = 1 - P(\overline{C}) = P(C).$$

In the above examples, element D can be considered a major function for which the basic sensitivity input $P(\mathcal{A}|\overline{D})$ is available. We now consider cases in which a function is in two major functional paths. The simplest case is shown below:



C and D are both major functions for which sensitivity inputs $P(\mathcal{A}|\overline{C})$ and $P(\mathcal{A}|\overline{D})$ are available. But in this configuration a failure of A might produce a failure of both C and D. Major functions are assumed to be independent, and a term such as $P(\mathcal{A}|\overline{C})$ actually means the accident probability <u>if only major function C</u> is failed. With this definition, if independence of $P(\mathcal{A}|\overline{C})$ and $P(\mathcal{A}|\overline{D})$ is assumed, we then have

$$P(\mathcal{A}|i_a) = P(\overline{C}|i_a)P(D|i_a)P(\mathcal{A}|\overline{C})$$

$$+ P(\overline{D}|i_a)P(C|i_a)P(\mathcal{A}|\overline{D})$$

$$+ P(\overline{C}|i_a)P(\overline{D}|i_a)\{1 - P(\overline{\mathcal{A}}|\overline{C})P(\overline{\mathcal{A}}|\overline{D})\}$$

where $P(\overline{\mathcal{A}}|\overline{C})$ = probability of no accident given that just C is failed

$$= 1 - P(\mathcal{A}|\overline{C})$$

and where we state explicitly that

$$P(\mathcal{A}|\overline{C}) = P(\mathcal{A}|\overline{C}D)$$

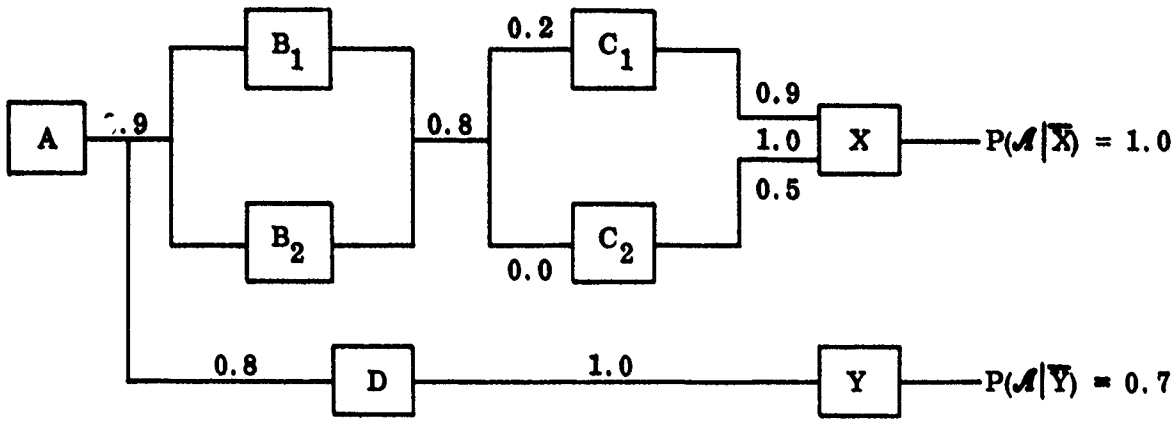
$$P(\mathcal{A}|\overline{D}) = P(\mathcal{A}|C\overline{D})$$

$$P(\mathcal{A}|\overline{C}\,\overline{D}) = 1 - P(\overline{\mathcal{A}}|\overline{C})P(\overline{\mathcal{A}}|\overline{D})$$

$$P(\overline{C}\,\overline{D}|\overline{A}) = P(\overline{C}|\overline{A})P(\overline{D}|\overline{A}).$$

C.4 EXAMPLE

The diagram below will be used to illustrate the above models.



That is, there is a 100% probability of an accident if function X fails, and a 70% probability of an accident if Y fails.

Two major functions, X and Y, are involved. B_1 and B_2 are a redundant configuration, while C_1 and C_2 represent parallel functions. The required link dependency and accident sensitivity values are shown on the diagram.

It is seen from the link dependency values that A is not completely essential in that there is a non-zero probability that successor functions can provide acceptable outputs if A has failed. Also, if B fails ($\overline{B}_1$ and $\overline{B}_2$) C_1 will always fail, e.g.,

$$P(\overline{C}_1\overline{C}_2|\overline{B}) + P(\overline{C}_1 C_2|\overline{B}) = 0.8 + 0.2 = 1.0;$$

however the probability of C_2 failing is 0.8.

C.4.1 **Element in A**

$$P(\mathcal{A}|i_a) = P(\overline{X}Y|i_a)P(\mathcal{A}|\overline{X}) + P(X\overline{Y}|i_a)P(\mathcal{A}|\overline{Y}) + P(\overline{X}\overline{Y}|i_a)\{1 - P(\overline{\mathcal{A}}|\overline{X})P(\overline{\mathcal{A}}|\overline{Y})\}$$

$$= P(\overline{A}|i_a)\{P(\overline{X}|\overline{A})P(Y|\overline{A})(1.0) + P(X|\overline{A})P(\overline{Y}|\overline{A})(0.7)$$

$$+ P(\overline{X}\overline{Y}|i_a)\{1 - (0.0)(0.3)\}.$$

We therefore have to calculate $P(\overline{X}|\overline{A})$ and $P(\overline{Y}|\overline{A})$:

$$P(\overline{X}|\overline{A}) = P(\overline{C}'|\overline{A})P(\overline{X}|\overline{C}') \qquad (\overline{C}' = \overline{C}_1C_2 + C_1\overline{C}_2 + \overline{C}_1\overline{C}_2)$$

$$= P(\overline{C}_1C_2|\overline{A})P(\overline{X}|\overline{C}_1C_2) + P(C_1\overline{C}_2|\overline{A})P(\overline{X}|C_1\overline{C}_2) + P(\overline{C}_1\overline{C}_2|\overline{A})P(\overline{X}|\overline{C}_1\overline{C}_2)$$

$$= (0.9)P(\overline{C}_1C_2|\overline{A}) + (0.5)P(C_1\overline{C}_2|\overline{A}) + (1.0)P(\overline{C}_1\overline{C}_2|\overline{A})$$

$$= \{(0.9)P(\overline{C}_1C_2|\overline{B}) + (0.5)P(C_1\overline{C}_2|\overline{B}) + (1.0)P(\overline{C}_1\overline{C}_2|\overline{B})\}P(\overline{B}|\overline{A})$$

$$= \{(0.9)(0.2) + (0.5)(0.0) + (1.0)(0.8)\}P(\overline{B}|\overline{A})$$

$$= (0.98)P(\overline{B}|\overline{A})$$

$$= (0.98)(0.90)$$

$$= 0.882.$$

$$P(\overline{Y}|\overline{A}) = P(\overline{D}|\overline{A})P(\overline{Y}|\overline{D})$$

$$= (0.8)(1.0)$$

$$= 0.8$$

Hence

$$P(\mathcal{A}|i_a) = P(\overline{A}|i_a)\{P(\overline{X}|\overline{A})P(Y|\overline{A})(1.0) + P(X|\overline{A})P(\overline{Y}|\overline{A})(0.7)$$

$$+ P(\overline{X}|\overline{A})P(\overline{Y}|\overline{A})(1.0)\}$$

$$= P(\overline{A}|i_a)\{(0.882)(0.2)(1.0) + (0.118)(0.8)(0.7) + (0.882)(0.8)(1.0)\}$$

$$= 0.9481\ P(\overline{A}|i_a)$$

Note that if A were essential to B, and B were essential to C, X would fail since both C_1 and C_2 would fail; and therefore $P(\mathcal{A}|i_a) = P(\mathcal{A}|\overline{X}) = 1.0$. To demonstrate the validity of this result, we can take the expression:

$$P(\mathcal{A}|i_a) = P(\overline{X}Y|i_a)P(\mathcal{A}|\overline{X}) + P(X\overline{Y}|i_a)P(\mathcal{A}|\overline{Y}) + P(\overline{X}\overline{Y}|i_a)\{1 - P(\overline{\mathcal{A}}|\overline{X})P(\overline{\mathcal{A}}|\overline{Y})\}.$$

Because of the new constraints, $P(X\overline{Y}|i_a) = 0$ since $P(\overline{X}|i_a) = 1.0$. Therefore the expression simplifies to:

$$P(\mathcal{A}|i_a) = P(Y|i_a)P(\mathcal{A}|\overline{X}) + P(\overline{Y}|i_a)\{1 - P(\overline{\mathcal{A}}|\overline{X})P(\overline{\mathcal{A}}|\overline{Y})\}$$

$$= (0.8)(1.0) + (0.2)1.0$$

$$= 1.0$$

C.4.2 Element in B_1

When examining an element in B_1 we no longer need consider the Y major function, since its success is independent of B. We therefore have:

$$P(\mathcal{A}|i_{b_1}) = P(\overline{X}|i_{b_1})P(\mathcal{A}|\overline{X})$$

$$= P(\overline{X}|i_{b_1})(1.0)$$

$$= \{P(\overline{C}_1C_2|i_{b_1})P(\overline{X}|\overline{C}_1C_2) + P(C_1\overline{C}_2|i_{b_1})P(\overline{X}|C_1\overline{C}_2)$$

$$+ P(\overline{C}_1\overline{C}_2|i_{b_1})P(\overline{X}|\overline{C}_1\overline{C}_2)\}(1.0)$$

$$= \{(0.9)P(\overline{C}_1C_2|i_{b_1}) + (0.5)P(C_1\overline{C}_2|i_{b_1}) + (1.0)P(\overline{C}_1\overline{C}_2|i_{b_1})\}(1.0)$$

$$= P(\overline{B}|i_{b_1})\{(0.9)P(\overline{C}_1C_2|\overline{B}) + (0.5)P(C_1\overline{C}_2|\overline{B}) + (1.0)P(\overline{C}_1\overline{C}_2|\overline{B})\}(1.0)$$

$$= P(\overline{B}_1|i_{b_1})P(\overline{B}_2)\{(0.9)(0.2) + (0.5)(0.0) + (1.0)(0.8)\}(1.0)$$

$$= (0.98)P(\overline{B}_1|i_{b_1})P(\overline{B}_2)$$

C.4.3 **Element in C_1**

$$P(\mathcal{A}|i_{c_1}) = P(\overline{X}|i_{c_1})P(\mathcal{A}|\overline{X})$$

$$= P(\overline{X}|i_{c_1})(1.0)$$

$$= P(\overline{C}_1C_2|i_{c_1})P(\overline{X}|\overline{C}_1C_2) + P(C_1\overline{C}_2|i_{c_1})P(\overline{X}|C_1\overline{C}_2) + P(\overline{C}_1\overline{C}_2|i_{c_1})P(\overline{X}|\overline{C}_1\overline{C}_2)$$

$$= P(\overline{C}_1|i_{c_1})\{P(C_2)(0.9) + (0.0)(0.5) + P(\overline{C}_2)(1.0)\}$$

$$= P(\overline{C}_1|i_{c_1})\{0.9\ P(C_2) + P(\overline{C}_2)\}$$

C.4.4 **Element in D**

$$P(\mathcal{A}|i_d) = P(\overline{D}|i_d)P(\overline{Y}|\overline{D})P(\mathcal{A}|\overline{D})$$

$$= P(\overline{D}|i_a)(1.0)(0.7)$$

$$= (0.7)P(\overline{D}|i_d)$$

APPENDIX D

WORK UNIT CODE CRITICALITY PRINTOUT

APPENDIX D

This appendix contains the flight-safety criticality assessment for the F-4J aircraft.

These criticalities are based on the combined failure data for May 1968 through April 1969, the flight history for the same period, the sensitivity values for each Work Unit Code's functional path, and the weighting factors applicable to the distribution of system failure probability derived from the VF-121 data collection effort.

All conditional or provisory factors were set to zero for this model exercise. The criticalities therefore are based on VFR daylight mission with field takeoff and landing in which backup (emergency) systems are available but not needed. This appendix is divided into two sections, the first ranking WUC's by their criticality, and the second listing the same information but sorted according to WUC.

The format used in the printout shows the WUC on the left followed by the name, the criticality in each mission phase, and finally the total criticality.

In cases where there are more than one alpha designator (more than one part having the same WUC), the name is listed with the applicable alpha designator; its criticalities are shown for each mission phase; and the combined criticalities for all alphas having that WUC are shown on the line in which the WUC is listed.

Mission phases are numbered in accordance with the footnote on page 2-5 of the report.

WUC'S RANKED ACCORDING TO CRITICALITY

WUC	CRITICALITIES BY FLIGHT PHASE PH1	PH2	PH3	PH4	PH5	PH6	PH7	PH8	PH9	TOTAL CRIT	CRIT RANK	TITLE
5711400	.00321	.00436	.00647	.00431	.00322	.00107	.00645	.00644	.00536	.04083	1	CONTROL AMPL.
1110400	.00090	.00110	.00106	.00081	.00197	.00146	.00148	.00172	.00204	.01254	2	CANOPY
42121	.00049	.00150	.00170	.00096	.00074	.00032	.00211	.00118	.00082	.00982	3	A.C. GENERATOR
14555	.00076	.00091	.00099	.00084	.00092	.00091	.00131	.00115	.00153	.00932	4	T.E. FLAP PWR.CONT.CYL.
51423	.00000	.00276	.00142	.00102	.00146	.00099	.00164	.00000	.00000	.00929	5	E.G.T. IND.
23A6200	.00067	.00087	.00063	.00048	.00053	.00092	.00063	.00067	.00077	.00617	6	MAIN FUEL CONTROL
42127	.00036	.00085	.00097	.00055	.00042	.00018	.00121	.00067	.00060	.00581	7	GEN. CONT. PANEL
51441	.00045	.00063	.00065	.00046	.00067	.00045	.00075	.00081	.00085	.00570	8	FUEL FLOW IND.
51453	.00045	.00063	.00065	.00046	.00066	.00045	.00074	.00081	.00082	.00567	9	OIL PRESS IND.
57115	.00041	.00055	.00083	.00056	.00042	.00014	.00083	.00083	.00069	.00526	10	YAW RATE GYRO
23A43	.00052	.00067	.00048	.00037	.00041	.00070	.00048	.00052	.00059	.00474	11	TEMP. AMPL.
42210	.00023	.00071	.00081	.00045	.00035	.00015	.00100	.00056	.00039	.00465	12	C.S.D.
4513C	.00056	.00025	.0003A	.00038	.00013	.00051	.00051	.00064	.00101	.00437	13	HYD. PUMP
49112	.00032	.00045	.00046	.00033	.00047	.00032	.00053	.00058	.00054	.00405	14	FIRE WARN LIT
14500	.00032	.00039	.00042	.00036	.00039	.00038	.00055	.00049	.00065	.00395	15	FLAP SYST.
57116	.00031	.00041	.00062	.00041	.00031	.00010	.00062	.00062	.00052	.00392	16	PITCH RATE GYRO
51844	.00061	.00000	.00000	.00013	.00045	.00049	.00091	.00110	.00000	.00369	17	FUEL QUANTITY IND.
4631100	.00000	.00000	.00000	.00087	.00058	.00058	.00087	.00068	.00000	.00358	18	
51851	.00000	.00000	.0006B	.00058	.00082	.00057	.00080	.00000	.00000	.00345	19	
23A6A	.00037	.00048	.00034	.00026	.00029	.0005C	.00034	.00037	.00042	.00337	20	
51442	.00025	.00035	.00037	.00026	.00037	.00026	.00042	.00046	.00047	.00321	21	
57112	.00025	.00033	.00050	.00034	.00025	.00008	.00050	.00050	.00042	.00317	22	
13347	.00002	.00119	.00000	.00000	.00000	.00000	.00000	.00156	.00032	.00309	23	
41552	.00025	.00031	.00032	.00022	.00047	.00028	.00032	.00038	.00044	.00299	24	
47111	.00000	.00000	.00034	.00049	.00106	.00063	.00042	.00000	.00000	.00294	25	
14540	.00024	.00029	.00031	.00026	.00029	.00028	.00041	.00036	.00048	.00292	26	
46232	.00000	.00040	.00040	.00040	.00027	.00027	.00038	.00033	.00000	.00245	27	
49122	.00018	.00025	.00026	.00018	.00026	.00018	.00030	.00032	.00033	.00226	28	
46171	.00000	.0003B	.00036	.00037	.00024	.00024	.00035	.00030	.00000	.00222	29	
14553	.00018	.00021	.00023	.00020	.00021	.00021	.00030	.00027	.00036	.00217	30	
11331	.00017	.00022	.00017	.00013	.00032	.00024	.00022	.00029	.00041	.00217	31	
2931E	.00023	.00030	.00022	.00016	.00018	.00031	.00022	.00023	.00027	.00212	32	
57118	.00015	.00020	.00030	.00020	.00015	.00005	.00030	.00030	.00025	.00190	33	
51627	.00000	.00063	.00000	.00000	.00000	.00000	.00045	.00081	.00000	.00189	34	
29311	.00018	.00024	.00017	.00013	.00015	.00025	.00017	.00018	.00021	.00168	35	
57117	.00012	.00017	.00025	.00017	.00013	.00004	.00025	.00025	.00021	.00159	36	
44112	.00011	.00013	.00017	.00013	.00017	.00017	.00020	.00020	.00026	.00154	37	
14822	.00012	.00015	.00016	.00014	.00015	.00015	.00021	.00019	.00025	.00152	38	
14823	.00012	.00015	.00016	.00014	.00015	.00015	.00021	.00019	.00025	.00152	39	
51411	.00000	.00071	.00015	.00010	.00015	.00010	.00017	.00009	.00000	.00147	40	
47215	.00000	.00000	.00011	.00028	.00059	.00035	.00014	.00000	.00000	.00147	41	
23A03	.00016	.00020	.00015	.00011	.00012	.00021	.00015	.00016	.00018	.00144	42	
14818	.00012	.00014	.00015	.00013	.00014	.00014	.00020	.00017	.00023	.00142	43	
23A6210	.00015	.00019	.00014	.00011	.00012	.00020	.00014	.00015	.00017	.00137	44	
13211	.00002	.00013	.00011	.00007	.00007	.00007	.00009	.00037	.00039	.00137	45	
51434	.00010	.00014	.00015	.00010	.00015	.00010	.00017	.00018	.00019	.00128	46	
1231D	.00000	.00006	.00024	.00017	.00023	.00017	.00025	.00009	.00000	.00123	47	
23A4340	.00000	.00023	.00016	.00012	.00014	.00024	.00016	.00017	.00000	.00122	48	
29312	.00011	.00019	.00012	.00009	.00010	.00018	.00012	.00012	.00013	.00116	49	
13111	.00002	.00017	.00010	.00006	.00006	.00006	.00008	.00025	.00035	.00115	50	
29310	.00012	.00010	.00011	.00009	.00009	.00016	.00011	.00012	.00014	.00110	51	
14510	.0000A	.00010	.00011	.00009	.00010	.00010	.00015	.00013	.00017	.00103	52	
14P16	.00008	.00010	.00011	.00009	.00010	.00010	.00015	.00013	.00017	.00103	53	
123A3	.00000	.00006	.00020	.00014	.00019	.00014	.00021	.00008	.00000	.00102	54	
41132	.00002	.00009	.00012	.00010	.00022	.00013	.00015	.00015	.00000	.00101	55	
29C15	.00010	.00013	.00009	.00007	.00008	.00014	.00009	.00010	.00012	.00092	56	
23A08	.00010	.00013	.00009	.00007	.00008	.00014	.00009	.00010	.00012	.00092	57	
14556	.00001	.00022	.00001	.00001	.00001	.00001	.00017	.00043	.00002	.00089	58	
13234	.00001	.00012	.00007	.00004	.00004	.00004	.00006	.00024	.00024	.00086	59	
51845	.00000	.00018	.00012	.00008	.00012	.00008	.00005	.00011	.00000	.00082	60	
42128	.00005	.00012	.00013	.00008	.00006	.00002	.00[illegible]	.00009	.00008	.00080	61	
14423	.00000	.00022	.00008	.00005	.00005	.00005	.00007	.00027	.00000	.00079	62	
4622A	.00000	.00012	.00014	.00014	.00008	.00008	.00012	.00010	.00000	.00078	63	
4513A	.00011	.00004	.00006	.00006	.00002	.00009	.00009	.00011	.00019	.00077	64	
41125	.00000	.00000	.00008	.00014	.00029	.00017	.00009	.00000	.00000	.00077	65	
23AA4	.00008	.00011	.00008	.00006	.00007	.00011	.00008	.00008	.00010	.00077	66	
41148	.00001	.00006	.00009	.00008	.00017	.00010	.00011	.00011	.00002	.00075	67	
4614E	.00000	.00013	.00011	.00011	.00007	.00008	.00011	.00012	.00000	.00073	68	
14332	.00000	.00009	.00010	.00008	.00009	.00009	.00013	.00012	.00000	.00070	69	
11333	.00014	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00056	.00070	70	
13143	.00001	.00015	.00004	.00002	.00002	.00002	.00003	.00025	.00015	.00069	71	
45112	.00000	.00007	.00009	.00009	.00003	.00012	.00012	.00017	.00000	.00069	72	
46314	.00000	.00000	.00000	.00017	.00011	.00011	.00017	.00013	.00000	.00069	73	
46431	.00000	.00010	.00011	.00011	.00007	.00007	.00011	.00012	.00000	.00069	74	
51846	.00000	.00015	.00010	.00007	.00010	.00007	.00011	.00009	.00000	.00069	75	
41216	.00000	.00000	.00008	.00011	.00024	.00014	.00009	.00000	.00000	.00066	76	
42111	.00001	.00007	.00012	.00008	.00007	.00003	.00019	.00008	.00001	.00066	77	
14115	.00000	.0000F	.00009	.00008	.00008	.00008	.00012	.00010	.00000	.00063	78	
45142	.00000	.00006	.00008	.00008	.00003	.00010	.00010	.00014	.00000	.00059	79	
14520	.00005	.00006	.00006	.00005	.00006	.00005	.00008	.00007	.00009	.00057	80	
46167	.00000	.00008	.00009	.00009	.00006	.00006	.00009	.00009	.00000	.00056	81	
47117	.00000	.00000	.00010	.00008	.00018	.00010	.00010	.00000	.00000	.00056	82	
4521C	.00000	.00003	.00007	.00008	.00003	.00010	.00010	.00013	.00000	.00054	83	
51424	.00002	.00003	.00008	.00005	.00008	.00005	.00008	.00005	.00004	.00053	84	
1111410	.00004	.00005	.00004	.00003	.00008	.00006	.00006	.00007	.00009	.00052	85	
23A92	.00006	.00007	.00005	.00004	.00004	.00008	.00005	.00006	.00006	.00051	86	
5711A	.00004	.00005	.00008	.00005	.00004	.00001	.00008	.00008	.00007	.00050	87	
14811	.00004	.00005	.00005	.00004	.00005	.00005	.00007	.00006	.00008	.00049	88	
45130	.00007	.00003	.00004	.00004	.00001	.00005	.00006	.00007	.00012	.00049	89	
4112E	.00000	.00000	.00004	.00010	.00020	.00010	.00005	.00000	.00000	.00049	90	
42122	.00003	.00007	.00008	.00004	.00003	.00001	.00009	.00005	.00005	.00045	91	
11334	.00004	.00005	.00003	.00003	.00006	.00005	.00004	.00006	.00009	.00045	92	
1111420	.00003	.00004	.00004	.00003	.00007	.00005	.00005	.00006	.00007	.00044	93	
23A4440	.00003	.00007	.00005	.00004	.00004	.00007	.00005	.00005	.00004	.00044	94	
23A1140	.00005	.00006	.00004	.00003	.00004	.00006	.00004	.00005	.00005	.00042	95	
123A2	.00000	.00003	.00008	.00006	.00008	.00006	.00008	.00003	.00000	.00042	96	
45123	.00000	.00004	.00006	.00006	.00002	.00007	.00007	.00010	.00000	.00042	97	

WUC'S RANKED ACCORDING TO CRITICALITY

WUC	CRITICALITIES BY FLIGHT PHASE PH1	PH2	PH3	PH4	PH5	PH6	PH7	PH8	PH9	TOTAL CRIT	CRIT RANK	TITLE
5711400	.00321	.00436	.00647	.00431	.00322	.00107	.00645	.00644	.00536	.04083	1	CONTROL AMPL.
1114400	.00090	.00110	.00106	.00081	.00197	.00146	.00148	.00172	.00284	.01254	2	CANOPY
42121	.00049	.00150	.00170	.00096	.00074	.00032	.00211	.00118	.00062	.00982	3	A.C. GENERATOR
10855	.00076	.00091	.00099	.00084	.00092	.00091	.00131	.00115	.00153	.00932	4	T.E. FLAP PWR.CONT.CYL.
51423	.00000	.00276	.00142	.00102	.00146	.00099	.00164	.00000	.00000	.00929	5	E.G.T. IND.
23A6200	.00067	.00087	.00063	.00048	.00083	.00092	.00063	.00067	.00077	.00617	6	MAIN FUEL CONTROL
42127	.00036	.00085	.00097	.00055	.00042	.00018	.00121	.00067	.00060	.00581	7	GEN. CONT. PANEL
51441	.00045	.00063	.00065	.00046	.00067	.00045	.00075	.00081	.00083	.00570	8	FUEL FLOW IND.
51433	.00045	.00063	.00065	.00046	.00066	.00045	.00074	.00081	.00082	.00567	9	OIL PRESS IND.
57115	.00041	.00055	.00083	.00056	.00042	.00014	.00083	.00083	.00069	.00526	10	YAW RATE GYRO
23A93	.00052	.00067	.00048	.00037	.00041	.00070	.00048	.00052	.00059	.00474	11	TEMP. AMPL.
42210	.00023	.00071	.00081	.00045	.00035	.00015	.00100	.00056	.00039	.00465	12	C.S.D.
4513C	.00056	.00025	.0003A	.00038	.00013	.00051	.00051	.00064	.00101	.00437	13	HYD. PUMP
49112	.00032	.00045	.00046	.00033	.00047	.00032	.00053	.00058	.00059	.00405	14	FIRE WARN LIT
14500	.00032	.00030	.00042	.00036	.00039	.00038	.00055	.00049	.00065	.00395	15	FLAP SYST.
57116	.00031	.00041	.00062	.00041	.00031	.00010	.00062	.00062	.00052	.00392	16	PITCH RATE GYRO
51844	.00061	.00000	.00000	.00013	.00045	.00049	.00091	.00110	.00000	.00369	17	FUEL QUANTITY IND.
4631100	.00000	.00000	.00000	.00067	.00058	.00058	.00067	.00068	.00000	.00358	18	
51851	.00000	.00000	.00068	.00058	.00082	.00057	.00080	.00000	.00000	.00345	19	
23A6A	.00037	.00048	.00034	.00026	.00029	.00050	.00034	.00037	.00042	.00337	20	
51442	.00025	.00035	.00037	.00026	.00037	.00026	.00042	.00046	.00047	.00321	21	
57112	.00025	.00033	.00050	.00034	.00025	.00008	.00050	.00050	.00042	.00317	22	
13347	.00082	.00119	.00000	.00000	.00000	.00000	.00000	.00156	.00032	.00309	23	
41552	.00025	.00031	.00032	.00022	.00047	.00028	.00032	.00038	.00044	.00299	24	
47111	.00000	.00000	.00034	.00049	.00106	.00063	.00042	.00000	.00000	.00294	25	
14540	.00024	.00029	.00031	.00026	.00029	.00028	.00041	.00036	.00048	.00292	26	
46232	.00000	.00040	.00040	.00040	.00027	.00027	.00038	.00033	.00000	.00245	27	
49122	.00018	.00025	.00026	.00018	.00026	.00018	.00030	.00032	.00033	.00286	28	
46171	.00000	.00036	.00036	.00037	.00024	.00024	.00035	.00030	.00000	.00222	29	
14553	.00018	.00021	.00023	.00020	.00021	.00021	.00030	.00027	.00036	.00217	30	
11331	.00017	.00022	.00017	.00013	.00032	.00024	.00022	.00029	.00041	.00217	31	
2931E	.00023	.00030	.00022	.00016	.00018	.00031	.00022	.00023	.00027	.00212	32	
57118	.00015	.00020	.00030	.00020	.00015	.00005	.00030	.00030	.00025	.00190	33	
51627	.00000	.00063	.00000	.00000	.00000	.00000	.00045	.00081	.00000	.00189	34	
29311	.00018	.00024	.00017	.00013	.00015	.00025	.00017	.00018	.00021	.00168	35	
57117	.00012	.00017	.00025	.00017	.00013	.00004	.00025	.00025	.00021	.00159	36	
44112	.00011	.00013	.00017	.00013	.00017	.00017	.00020	.00020	.00026	.00154	37	
14822	.00012	.00015	.00016	.00014	.00015	.00015	.00021	.00019	.00025	.00152	38	
14823	.00012	.00015	.00016	.00014	.00015	.00015	.00021	.00019	.00025	.00152	39	
51411	.00000	.00071	.00015	.00010	.00015	.00010	.00017	.00009	.00000	.00147	40	
47215	.00000	.00000	.00011	.00028	.00059	.00035	.00014	.00000	.00000	.00147	41	
23A63	.00016	.00020	.00015	.00011	.00012	.00021	.00015	.00016	.00018	.00144	42	
14218	.00012	.00014	.00015	.00013	.00014	.00014	.00020	.00017	.00023	.00142	43	
23A6210	.00015	.00019	.00014	.00011	.00012	.00020	.00014	.00015	.00017	.00137	44	
13211	.00002	.00013	.00011	.00007	.00007	.00007	.00009	.00037	.00039	.00137	45	
51434	.00010	.00014	.00015	.00010	.00015	.00010	.00017	.00018	.00019	.00128	46	
1231D	.00000	.00008	.00024	.00017	.00023	.00017	.00025	.00009	.00000	.00123	47	
23A4340	.00000	.00023	.00016	.00012	.00014	.00024	.00016	.00017	.00000	.00122	48	
29312	.00011	.00019	.00012	.00009	.00010	.00018	.00012	.00012	.00013	.00116	49	
13111	.00002	.00017	.00010	.00006	.00006	.00006	.00008	.00025	.00035	.00115	50	
29310	.00012	.00010	.00011	.00009	.00009	.00016	.00011	.00012	.00014	.00110	51	
14510	.00008	.00010	.00011	.00009	.00010	.00010	.00015	.00013	.00017	.00103	52	
14R16	.00008	.00010	.00011	.00009	.00010	.00010	.00015	.00013	.00017	.00103	53	
12343	.00000	.00006	.00020	.00014	.00019	.00014	.00021	.00008	.00000	.00102	54	
41132	.00002	.00009	.00012	.00010	.00022	.00013	.00015	.00015	.00009	.00101	55	
29C15	.00010	.00013	.00009	.00007	.00008	.00014	.00009	.00010	.00012	.00092	56	
23A68	.00010	.00013	.00009	.00007	.00008	.00014	.00009	.00010	.00012	.00092	57	
1456F	.00001	.00022	.00001	.00001	.00001	.00001	.00017	.00043	.00002	.00089	58	
13234	.00001	.00012	.00007	.00004	.00004	.00004	.00006	.00024	.00024	.00086	59	
51845	.00000	.00018	.00012	.00008	.00012	.00008	.00013	.00011	.00000	.00082	60	
42128	.00005	.00012	.00013	.00008	.00006	.00002	.00017	.00009	.00008	.00080	61	
14423	.00000	.00022	.00008	.00005	.00005	.00005	.00007	.00027	.00000	.00079	62	
4622A	.00000	.00012	.00014	.00014	.00008	.00008	.00012	.00010	.00000	.00078	63	
4513A	.00011	.00004	.00006	.00006	.00002	.00009	.00009	.00011	.00019	.00077	64	
41125	.00000	.00000	.00008	.00014	.00029	.00017	.00009	.00000	.00000	.00077	65	
23AA4	.00008	.00011	.00008	.00006	.00007	.00011	.00008	.00008	.00010	.00077	66	
41148	.00001	.00006	.00009	.00008	.00017	.00010	.00011	.00011	.00002	.00075	67	
4614E	.00000	.00013	.00011	.00011	.00007	.00008	.00011	.00012	.00000	.00073	68	
14332	.00000	.00009	.00010	.00008	.00009	.00009	.00013	.00012	.00000	.00070	69	
11333	.00014	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00056	.00070	70	
13143	.00001	.00015	.00004	.00002	.00002	.00002	.00003	.00025	.00015	.00069	71	
45112	.00000	.00007	.00009	.00009	.00003	.00012	.00012	.00017	.00000	.00069	72	
46314	.00000	.00000	.00000	.00017	.00011	.00011	.00017	.00013	.00000	.00069	73	
46431	.00000	.00010	.00011	.00011	.00007	.00007	.00011	.00012	.00000	.00069	74	
51846	.00000	.00015	.00010	.00007	.00010	.00007	.00011	.00009	.00000	.00069	75	
41216	.00000	.00000	.00008	.00011	.00024	.00014	.00009	.00000	.00000	.00066	76	
42111	.00001	.00007	.00012	.00008	.00007	.00003	.00019	.00008	.00001	.00066	77	
14115	.00000	.00008	.00009	.00008	.00008	.00008	.00012	.00010	.00000	.00063	78	
45142	.00000	.00006	.00008	.00008	.00003	.00010	.00010	.00014	.00000	.00059	79	
14520	.00005	.00006	.00006	.00005	.00006	.00005	.00008	.00007	.00009	.00057	80	
46167	.00000	.00008	.00009	.00009	.00006	.00006	.00009	.00009	.00000	.00056	81	
47117	.00000	.00000	.00010	.00008	.00018	.00010	.00010	.00000	.00000	.00056	82	
4521C	.00000	.00003	.00007	.00008	.00003	.00010	.00010	.00013	.00000	.00054	83	
51424	.00002	.00006	.00008	.00005	.00008	.00005	.00008	.00005	.00004	.00053	84	
1111410	.00004	.00005	.00004	.00003	.00008	.00006	.00006	.00007	.00009	.00052	85	
23A92	.00006	.00007	.00005	.00004	.00004	.00008	.00005	.00006	.00006	.00051	86	
5711A	.00004	.00005	.00008	.00005	.00004	.00001	.00008	.00008	.00007	.00050	87	
14811	.00004	.00005	.00005	.00004	.00005	.00005	.00007	.00006	.00008	.00049	88	
4513D	.00007	.00003	.00004	.00004	.00001	.00005	.00006	.00007	.00012	.00049	89	
4112E	.00000	.00000	.00004	.00010	.00020	.00010	.00005	.00000	.00000	.00049	90	
42122	.00003	.00007	.00008	.00004	.00003	.00001	.00009	.00005	.00005	.00045	91	
11334	.00004	.00005	.00003	.00003	.00006	.00005	.00004	.00006	.00009	.00045	92	
1111420	.00003	.00004	.00004	.00003	.00007	.00005	.00005	.00006	.00007	.00044	93	
23A4440	.00003	.00007	.00005	.00004	.00004	.00007	.00005	.00005	.00004	.00044	94	
23A1140	.00005	.00006	.00004	.00003	.00004	.00006	.00004	.00005	.00005	.00042	95	
123A2	.00000	.00003	.00008	.00006	.00008	.00006	.00008	.00003	.00000	.00042	96	
45123	.00000	.00004	.00006	.00006	.00002	.00007	.00007	.00010	.00000	.00042	97	

	CRITICALITIES BY FLIGHT PHASE									TOTAL	CRIT
WPN	PH1	PH2	PH3	PH4	PH5	PH6	PH7	PH8	PH9	CRIT	RANK
51412	.00000	.00020	.00004	.00003	.00004	.00003	.00005	.00003	.00000	.00042	98
442C8	.00000	.00000	.00000	.00007	.00000	.00000	.00010	.00007	.00000	.00041	99
13047	.00000	.00000	.00000	.00000	.00005	.00005	.00013	.00017	.00000	.00040	100
41851	.00003	.00004	.00004	.00003	.00004	.00004	.00004	.00005	.00004	.00030	101
41120	.00000	.00000	.00002	.00000	.00010	.00008	.00002	.00000	.00000	.00036	102
41533	.00000	.00011	.00000	.00000	.00000	.00000	.00011	.00013	.00000	.00035	103
12312	.00000	.00003	.00007	.00005	.00004	.00005	.00007	.00003	.00000	.00035	104
12315	.00000	.00002	.00007	.00005	.00004	.00005	.00007	.00003	.00000	.00035	105
23A5200	.00004	.00005	.00003	.00003	.00003	.00005	.00003	.00004	.00004	.00034	106
5711L	.00003	.00004	.00005	.00004	.00003	.00001	.00005	.00005	.00004	.00034	107
41637	.00000	.00005	.00004	.00003	.00005	.00003	.00004	.00004	.00000	.00033	108
41442	.00005	.00000	.00000	.00001	.00004	.00004	.00008	.00010	.00000	.00032	109
51811	.00000	.00004	.00005	.00003	.00005	.00003	.00005	.00004	.00000	.00031	110
51648	.00000	.00010	.00000	.00000	.00000	.00000	.00007	.00014	.00000	.00031	111
47215	.00000	.00000	.00002	.00004	.00012	.00007	.00003	.00000	.00000	.00030	112
47112	.00000	.00000	.00003	.00005	.00011	.00007	.00004	.00000	.00000	.00030	113
4512A	.00000	.00003	.00004	.00004	.00001	.00005	.00005	.00007	.00000	.00029	114
41542	.00000	.00000	.00000	.00000	.00000	.00000	.00009	.00011	.00000	.00029	115
42143	.00002	.00004	.00005	.00003	.00002	.00001	.00004	.00003	.00003	.00029	116
000	.30000	.30000	.30000	.30000	.30000	.00003	.00004	.00003	.00005	.00029	117
14814	.00002	.00003	.00003	.00003	.00003	.00003	.00004	.00003	.00005	.00029	118
14815	.00002	.00003	.00003	.00003	.00003	.00003	.00004	.00003	.00005	.00029	119
46231	.00000	.00000	.00014	.00014	.00000	.00000	.00000	.00000	.00000	.00028	120
46112	.00000	.00004	.00004	.00004	.00003	.00003	.00005	.00004	.00000	.00027	121
23AA1	.00003	.00004	.00001	.00002	.00002	.00004	.00003	.00003	.00003	.00027	122
1462A	.00000	.00000	.00000	.00000	.00003	.00003	.00009	.00012	.00000	.00027	123
23A41	.00003	.00004	.00003	.00002	.00002	.00004	.00003	.00003	.00003	.00027	124
23A41	.00002	.00004	.00003	.00002	.00002	.00004	.00003	.00003	.00003	.00026	125
13210	.00000	.00003	.00002	.00001	.00001	.00001	.00002	.00009	.00007	.00026	126
46161	.00000	.00004	.00004	.00004	.00003	.00003	.00004	.00004	.00000	.00026	127
46442	.00000	.00004	.00004	.00004	.00003	.00003	.00004	.00004	.00000	.00026	128
46417	.00000	.00004	.00004	.00004	.00003	.00003	.00004	.00004	.00000	.00026	129
4721H	.00000	.00000	.00002	.00005	.00010	.00006	.00002	.00000	.00000	.00025	130
46140	.00000	.00004	.00004	.00004	.00002	.00003	.00004	.00004	.00000	.00025	131
41115	.00000	.00000	.00003	.00004	.00009	.00005	.00004	.00000	.00000	.00025	132
13210	.00000	.00004	.00002	.00001	.00001	.00001	.00002	.00006	.00006	.00025	133
13142	.00000	.00004	.00003	.00002	.00002	.00002	.00002	.00006	.00004	.00025	134
13425	.00000	.00004	.00002	.00001	.00001	.00001	.00002	.00006	.00004	.00025	135
14210	.00000	.00004	.00003	.00003	.00003	.00003	.00004	.00005	.00000	.00025	136
23A3700	.00000	.00005	.00003	.00003	.00003	.00005	.00003	.00003	.00000	.00025	137
23A7140	.00000	.00004	.00003	.00002	.00003	.00005	.00003	.00002	.00000	.00024	138
14542	.00002	.00004	.00002	.00002	.00002	.00002	.00004	.00004	.00004	.00024	139
4613100	.00000	.00004	.00004	.00004	.00002	.00002	.00004	.00004	.00000	.00024	140
45136	.00002	.00004	.00002	.00002	.00000	.00003	.00003	.00005	.00004	.00024	141
45115	.00000	.00002	.00003	.00003	.00001	.00004	.00004	.00006	.00000	.00023	142
41113	.00000	.00000	.00001	.00004	.00008	.00005	.00003	.00000	.00000	.00023	143
41547	.00000	.00007	.00000	.00000	.00000	.00000	.00007	.00004	.00000	.00023	144
41238	.00002	.00002	.00002	.00002	.00004	.00002	.00002	.00003	.00003	.00022	145
46210	.00000	.00004	.00004	.00004	.00002	.00002	.00003	.00003	.00000	.00022	146
143.4	.00000	.00003	.00003	.00003	.00003	.00003	.00004	.00003	.00000	.00022	147
13112	.00000	.00002	.00002	.00001	.00001	.00001	.00002	.00005	.00007	.00022	148
13104	.00000	.00003	.00001	.00002	.00002	.00002	.00002	.00006	.00001	.00021	149
23A73	.00000	.00004	.00003	.00002	.00002	.00004	.00003	.00003	.00000	.00021	150
12731A	.00000	.00001	.00004	.00003	.00004	.00003	.00004	.00002	.00000	.00021	151
11311	.00000	.00003	.00002	.00002	.00003	.00003	.00003	.00003	.00000	.00021	152
46210	.00000	.00002	.00002	.00004	.00003	.00003	.00004	.00003	.00000	.00021	153
41126	.00000	.00000	.00002	.00003	.00008	.00005	.00003	.00000	.00000	.00021	154
41142	.00000	.00002	.00002	.00002	.00005	.00003	.00003	.00003	.00000	.00020	155
46025	.00000	.00000	.00000	.00005	.00003	.00003	.00005	.00004	.00000	.00020	156
45113	.00000	.00002	.00003	.00003	.00001	.00003	.00003	.00005	.00006	.00020	157
23A7100	.00000	.00005	.00003	.00002	.00008	.00004	.00002	.00002	.00000	.00020	158
14056	.00002	.00002	.00002	.00002	.00002	.00002	.00003	.00002	.00003	.00020	159
46115	.00000	.00003	.00003	.00003	.00002	.00002	.00003	.00003	.00000	.00019	160
46118	.00000	.00003	.00003	.00003	.00002	.00002	.00003	.00003	.00000	.00019	161
4111H	.00000	.00000	.00002	.00003	.00007	.00004	.00003	.00000	.00000	.00019	162
42141	.00001	.00003	.00003	.00002	.00001	.00001	.00004	.00002	.00002	.00019	163
14550	.00000	.00005	.00000	.00000	.00000	.00000	.00006	.00007	.00000	.00018	164
14200	.00000	.00005	.00002	.00001	.00001	.00001	.00002	.00006	.00000	.00018	165
13212	.00000	.00002	.00001	.00001	.00001	.00001	.00001	.00005	.00005	.00017	166
23A3000	.00002	.00002	.00002	.00001	.00001	.00003	.00002	.00002	.00002	.00017	167
23A4470	.00002	.00002	.00002	.00001	.00001	.00003	.00002	.00002	.00002	.00017	168
23A4480	.00002	.00002	.00002	.00001	.00001	.00003	.00002	.00002	.00002	.00017	169
41948	.00000	.00005	.00000	.00000	.00000	.00000	.00005	.00007	.00000	.00017	170
41514	.00000	.00001	.00000	.00000	.00000	.00000	.00005	.00007	.00000	.00017	171
41147	.00000	.00001	.00002	.00002	.00004	.00002	.00003	.00003	.00000	.00017	172
46225	.00000	.00000	.00000	.00004	.00003	.00003	.00004	.00003	.00000	.00017	173
46314	.00000	.00000	.00000	.00004	.00003	.00003	.00004	.00003	.00000	.00017	174
41843	.00003	.00000	.00000	.00001	.00002	.00002	.00004	.00005	.00000	.00017	175
5711F	.00001	.00002	.00003	.00002	.00001	.00000	.00003	.00003	.00002	.00017	176
47211	.00000	.00000	.00002	.00002	.00004	.00004	.00002	.00000	.00000	.00016	177
41629	.00000	.00005	.00002	.00001	.00001	.00001	.00001	.00005	.00000	.00016	178
13343	.00000	.00004	.00000	.00000	.00000	.00000	.00000	.00008	.00002	.00016	179
13321	.00000	.00002	.00001	.00001	.00001	.00001	.00001	.00004	.00005	.00016	180
12318	.00000	.00001	.00003	.00002	.00003	.00002	.00003	.00001	.00000	.00015	181
14B0E	.00000	.00004	.00000	.00000	.00000	.00000	.00005	.00006	.00000	.00015	182
123A4	.00000	.00001	.00003	.00002	.00003	.00002	.00003	.00001	.00000	.00015	183
12311	.00000	.00001	.00003	.00002	.00003	.00002	.00003	.00001	.00000	.00015	184
12313	.00000	.00001	.00003	.00002	.00003	.00002	.00003	.00001	.00000	.00015	185
47210	.00000	.00000	.00001	.00003	.00006	.00004	.00001	.00000	.00000	.00015	186
45135	.00002	.00001	.00001	.00001	.00000	.00002	.00002	.00002	.00004	.00015	187
41231	.00001	.00002	.00002	.00001	.00002	.00001	.00002	.00002	.00002	.00015	188
41111J	.00000	.00000	.00002	.00003	.00005	.00003	.00002	.00000	.00000	.00015	189
42142	.00000	.00000	.00003	.00003	.00003	.00001	.00005	.00000	.00000	.00015	190
46172	.00000	.00000	.00000	.00000	.00004	.00004	.00006	.00000	.00000	.00014	191
14241	.00000	.00004	.00001	.00001	.00001	.00001	.00001	.00005	.00000	.00014	192
14428	.00000	.00005	.00001	.00000	.00000	.00000	.00001	.00005	.00001	.00013	193
41621	.00000	.00000	.00001	.00000	.00000	.00000	.00000	.00004	.00000	.00013	194
41537	.00000	.00004	.00000	.00000	.00000	.00000	.00004	.00005	.00000	.00013	195

MUC	CRITICALITIES BY FLIGHT PHASE PH1	PH2	PH3	PH4	PH5	PH6	PH7	PH8	PH9	TOTAL CRIT	CRIT RANK
41541	.00000	.00000	.00000	.00000	.00000	.00000	.00004	.00005	.00000	.00013	196
41140	.00000	.00001	.00002	.00001	.00003	.00002	.00002	.00002	.00000	.00013	197
46213	.00001	.00001	.00001	.00001	.00001	.00001	.00002	.00002	.00002	.00012	198
46313	.00000	.00000	.00000	.00003	.00002	.00002	.00003	.00002	.00000	.00012	199
46233	.00000	.00000	.00006	.00006	.00000	.00000	.00000	.00000	.00000	.00012	200
46316	.00000	.00000	.00000	.00003	.00002	.00002	.00003	.00002	.00000	.00012	201
13121	.00000	.00002	.00001	.00001	.00001	.00001	.00001	.00002	.00003	.00012	202
13145	.00000	.00002	.00001	.00001	.00001	.00001	.00001	.00004	.00001	.00012	203
13252	.00000	.00002	.00001	.00001	.00001	.00001	.00001	.00002	.00003	.00012	204
23A65	.00000	.00004	.00002	.00001	.00001	.00002	.00001	.00001	.00000	.00012	205
23A78	.00000	.00002	.00002	.00001	.00001	.00002	.00002	.00002	.00000	.00012	206
23A8100	.00001	.00002	.00001	.00001	.00001	.00002	.00001	.00001	.00002	.00012	207
1655M	.00001	.00001	.00001	.00001	.00001	.00001	.00002	.00002	.00001	.00012	208
14623	.00000	.00000	.00000	.00000	.00002	.00002	.00004	.00004	.00000	.00012	209
51615	.00000	.00002	.00002	.00001	.00002	.00001	.00002	.00002	.00000	.00012	210
13341	.00000	.00004	.00000	.00000	.00000	.00000	.00000	.00006	.00001	.00011	211
46221	.00000	.00000	.00000	.00003	.00002	.00002	.00002	.00002	.00000	.00011	212
46218	.00000	.00002	.00002	.00002	.00001	.00001	.00002	.00001	.00000	.00011	213
4721C	.00000	.00000	.00001	.00002	.00004	.00002	.00001	.00000	.00000	.00010	214
42120	.00001	.00001	.00002	.00001	.00001	.00000	.00002	.00001	.00001	.00010	215
42125	.00001	.00001	.00002	.00001	.00001	.00000	.00002	.00001	.00001	.00010	216
14435	.00000	.00002	.00001	.00001	.00001	.00001	.00001	.00003	.00000	.00010	217
14119	.00000	.00002	.00001	.00001	.00001	.00001	.00001	.00003	.00000	.00010	218
14412	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00002	.00010	219
29A16	.00001	.00002	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00010	220
51A16	.00000	.00001	.00001	.00001	.00002	.00001	.00002	.00002	.00000	.00010	221
51814	.00000	.00001	.00001	.00001	.00001	.00001	.00002	.00002	.00000	.00009	222
51812	.00000	.00001	.00001	.00001	.00001	.00001	.00002	.00002	.00000	.00009	223
51822	.00000	.00001	.00001	.00002	.00001	.00001	.00002	.00002	.00000	.00009	224
23A4490	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00009	225
23A4471	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00009	226
23A4481	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00009	227
23A4482	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00009	228
23A4400	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00009	229
23A1150	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00009	230
41548	.00000	.00003	.00000	.00000	.00000	.00000	.00003	.00003	.00000	.00009	231
41230	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00009	232
41521	.00000	.00003	.00000	.00000	.00000	.00000	.00003	.00003	.00000	.00009	233
41114	.00000	.00000	.00001	.00002	.00003	.00002	.00001	.00000	.00000	.00009	234
51118	.00000	.00000	.00001	.00002	.00002	.00002	.00002	.00000	.00000	.00009	235
46142	.00000	.00001	.00000	.00002	.00001	.00001	.00002	.00002	.00000	.00009	236
45211	.00000	.00001	.00001	.00001	.00000	.00002	.00002	.00002	.00000	.00009	237
45134	.00001	.00000	.00001	.00001	.00000	.00001	.00001	.00001	.00002	.00008	238
41134	.00000	.00001	.00001	.00001	.00002	.00001	.00001	.00001	.00000	.00008	239
44217	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00008	240
1442L	.00000	.00004	.00000	.00000	.00000	.00000	.00000	.00004	.00000	.00008	241
11311	.00000	.00001	.00001	.00001	.00002	.00001	.00001	.00001	.00000	.00008	242
1431	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	243
14110	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	244
14311	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	245
14312	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	246
14313	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	247
13341	.00000	.00003	.00000	.00000	.00000	.00000	.00000	.00003	.00001	.00007	248
14610	.00000	.00000	.00000	.00000	.00001	.00001	.00003	.00002	.00000	.00007	249
23A67	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	250
41128	.00000	.00000	.00001	.00001	.00003	.00001	.00001	.00000	.00000	.00007	251
41120	.00000	.00000	.00001	.00001	.00003	.00001	.00001	.00000	.00000	.00007	252
46117	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	253
46122	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	254
46162	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	255
46164	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	256
51423	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	257
51413	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	258
45124	.00000	.00001	.00001	.00001	.00000	.00001	.00001	.00001	.00000	.00006	259
41123	.00000	.00000	.00000	.00001	.00003	.00002	.00000	.00000	.00000	.00006	260
41112	.00000	.00000	.00001	.00001	.00002	.00001	.00001	.00000	.00000	.00006	261
41411	.00000	.00000	.00001	.00001	.00002	.00001	.00001	.00000	.00000	.00006	262
41431	.00000	.00002	.00000	.00000	.00000	.00000	.00002	.00002	.00000	.00006	263
41211	.00000	.00000	.00001	.00001	.00002	.00001	.00001	.00000	.00000	.00006	264
41711	.00000	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00006	265
29A10	.00000	.00002	.00001	.00000	.00000	.00001	.00001	.00001	.00000	.00006	266
14621	.00000	.00000	.00000	.00000	.00001	.00001	.00002	.00002	.00000	.00006	267
12316	.00000	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00006	268
12317	.00000	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00006	269
11310	.00000	.00001	.00000	.00000	.00001	.00001	.00001	.00001	.00000	.00005	270
29A11	.00000	.00002	.00001	.00000	.00000	.00001	.00001	.00001	.00000	.00005	271
23A71.0	.00000	.00001	.00001	.00000	.00001	.00001	.00001	.00000	.00000	.00005	272
14432	.00000	.00002	.00000	.00000	.00000	.00000	.00000	.00003	.00000	.00005	273
42130	.00000	.00001	.00001	.00001	.00000	.00000	.00001	.00001	.00000	.00005	274
41135	.00000	.00000	.00001	.00000	.00001	.00001	.00001	.00001	.00000	.00005	275
45116	.00000	.00000	.00001	.00001	.00000	.00001	.00001	.00001	.00000	.00005	276
45210	.00000	.00000	.00001	.00001	.00000	.00001	.00001	.00001	.00000	.00005	277
46144	.00000	.00000	.00000	.00001	.00001	.00001	.00001	.00001	.00000	.00005	278
46153	.00000	.00000	.00000	.00001	.00001	.00001	.00001	.00001	.00000	.00005	279
46312	.00000	.00000	.00000	.00001	.00001	.00001	.00001	.00001	.00000	.00005	280
51613	.00000	.00002	.00001	.00000	.00000	.00000	.00000	.00001	.00000	.00004	281
4114A	.00000	.00000	.00000	.00000	.00001	.00001	.00001	.00001	.00000	.00004	282
41127	.00000	.00000	.00000	.00001	.00002	.00001	.00000	.00000	.00000	.00004	283
41143	.00000	.00000	.00000	.00000	.00001	.00001	.00001	.00001	.00000	.00004	284
41124	.00000	.00000	.00000	.00001	.00002	.00001	.00000	.00000	.00000	.00004	285
41118	.00000	.00000	.00000	.00001	.00001	.00001	.00001	.00000	.00000	.00004	286
4212H	.00000	.00001	.00001	.00000	.00000	.00000	.00001	.00001	.00000	.00004	287
13214	.00000	.00001	.00000	.00000	.00000	.00000	.00000	.00001	.00002	.00004	288
13215	.00000	.00001	.00000	.00000	.00000	.00000	.00000	.00001	.00002	.00004	289
51A54	.00000	.00000	.00000	.00001	.00001	.00001	.00001	.00000	.00000	.00004	290
1334A	.00000	.00001	.00000	.00000	.00000	.00000	.00000	.00002	.00000	.00003	291
13141	.00000	.00001	.00000	.00000	.00000	.00000	.00000	.00001	.00001	.00003	292
13411	.00000	.00002	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00003	293

UUC	CRITICALITIES BY FLIGHT PHASE PH1	PH2	PH3	PH4	PH5	PH6	PH7	PH8	PH9	TOTAL CRIT	CRIT RANK
29C11	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00003	.00000	.00003	294
41536	.00000	.00001	.00000	.00000	.00000	.00000	.00001	.00001	.00000	.00003	295
29C14	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00003	.00000	.00003	296
4112C	.00000	.00000	.00000	.00001	.00001	.00001	.00000	.00000	.00000	.00003	297
41141	.00000	.00000	.00000	.00000	.00001	.00000	.00001	.00001	.00000	.00003	298
41215	.00000	.00000	.00000	.00001	.00001	.00001	.00000	.00000	.00000	.00003	299
41523	.00000	.00001	.00000	.00000	.00000	.00000	.00001	.00001	.00000	.00003	300
51622	.00000	.00002	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00003	301
47116	.00000	.00000	.00000	.00001	.00001	.00001	.00000	.00000	.00000	.00003	302
47213	.00000	.00000	.00000	.00001	.00001	.00001	.00000	.00000	.00000	.00003	303
47210	.00000	.00000	.00000	.00000	.00001	.00001	.00000	.00000	.00000	.00002	304
46227	.00000	.00000	.00001	.00001	.00000	.00000	.00000	.00000	.00000	.00002	305
5162A	.00000	.00000	.00001	.00000	.00000	.00000	.00000	.00001	.00000	.00002	306
46121	.00000	.00000	.00001	.00001	.00000	.00000	.00000	.00000	.00000	.00002	307
46212	.00000	.00000	.00001	.00001	.00000	.00000	.00000	.00000	.00000	.00002	308
41117	.00000	.00000	.00000	.00000	.00001	.00001	.00000	.00000	.00000	.00002	309
41126	.00000	.00000	.00000	.00000	.00001	.00001	.00000	.00000	.00000	.00002	310
14611	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00001	.00000	.00002	311
23443J0	.00000	.00001	.00000	.00000	.00000	.00001	.00000	.00000	.00000	.00002	312
14269	.00000	.00001	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00002	313
14223	.00000	.00001	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00002	314
14337	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00001	.00000	.00002	315
14410	.00000	.00001	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00002	316
13346	.00000	.00001	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00002	317
51712	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00001	.00000	.00002	318
51714	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00001	319
51821	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00001	320
51855	.00000	.00000	.00000	.00000	.00001	.00000	.00000	.00000	.00000	.00001	321
23AA5	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00000	.00000	.00001	322
14628	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00000	.00001	323
29C17	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00001	324
4111C	.00000	.00000	.00000	.00000	.00001	.00000	.00000	.00000	.00000	.00001	325
4111D	.00000	.00000	.00000	.00000	.00001	.00000	.00000	.00000	.00000	.00001	326
4111F	.00000	.00000	.00000	.00000	.00001	.00000	.00000	.00000	.00000	.00001	327
4111H	.00000	.00000	.00000	.00000	.00001	.00000	.00000	.00000	.00000	.00001	328
45114	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00001	329
45117	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00001	330
51425	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00001	331
51625	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00001	332
46433	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00000	.00001	333
47113	.00000	.00000	.00000	.00000	.00001	.00000	.00000	.00000	.00000	.00001	334
47212	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
47227	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
47217	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
47221	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
5111C	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
5111F	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51111	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51112	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51113	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51114	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51211	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51212	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51115	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51132	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51136	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51142	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
44231	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
44232	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
45125	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4521E	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4521F	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4521A	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4521G	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
45215	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
45216	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
45312	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4532C	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
45321	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
45327J0	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
46211	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
46218	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
46222	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
46111	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
46133	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4614B	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4111N	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
41120	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
41118	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
41111	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
41318	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
41312	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
41313	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
41316	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
41213	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4131A	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
41145	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
41152	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
41153	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
41133	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
42112	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4212N	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
42151	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
42141	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4411B	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4411C	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4411D	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
44215	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	

WUC	CRITICALITIES BY FLIGHT PHASE PH1	PH2	PH3	PH4	PH5	PH6	PH7	PH8	PH9	TOTAL CRIT	CRIT RANK
44128	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
44118	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00630	
4412A	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
44121	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
44127	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
44227	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
44229	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
44225	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
44220	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
44221	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
44222	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
44223	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
44113	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4411P	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
44111	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
44114	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
44115	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
44116	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
44117	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4411E	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4411F	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
44116	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4411H	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4411J	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4411L	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4411M	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4411N	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
14631	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
23A6110	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
1351N	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
1341C	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
13422	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
13317	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
13152	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
13153	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
13155	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
1433B	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
14240	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
13515	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
13518	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
13612	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
11120	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
11310	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
56260	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
56450	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
56861	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51852	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51847	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
56865	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
57000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
6334100	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
6712D	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
6712E	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
6712F	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
6712H	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
71740	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
72362	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
73110	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
73124	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
73490	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
74984	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
74986	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
93111	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
93216	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
93112	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
93114	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
93211	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
93213	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	

CRITICALITY OF WUC'S, LISTED NUMERICALLY

WUC	CRITICALITIES BY FLIGHT PHASE PH1	PH2	PH3	PH4	PH5	PH6	PH7	PH8	PH9	TOTAL CRIT	CRIT RANK
11111[illegible]0	.00004	.00005	.00004	.00003	.00008	.00004	.00006	.00007	.00009	.00092	89
11111[illegible]20	.00003	.00004	.00004	.00003	.00007	.00005	.00005	.00006	.00007	.00044	93
11120	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
11130[illegible]00	.00000	.00110	.00104	.00001	.00197	.00146	.00148	.00172	.00204	.01294	2
11310	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
11311	.00000	.00003	.00002	.00002	.00005	.00003	.00003	.00003	.00000	.00021	192
11310	.00000	.00001	.00000	.00000	.00001	.00001	.00001	.00001	.00000	.00005	270
11318	.00000	.00001	.00001	.00001	.00002	.00001	.00001	.00001	.00000	.00008	242
11321	.00017	.00022	.00017	.00013	.00032	.00024	.00022	.00029	.00041	.00217	31
11333	.00014	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00036	.00070	70
11334	.00004	.00005	.00003	.00003	.00006	.00005	.00004	.00004	.00009	.00045	92
12311	.00000	.00001	.00003	.00002	.00003	.00002	.00003	.00001	.00000	.00015	184
12312	.00000	.00002	.00007	.00009	.00004	.00005	.00007	.00003	.00000	.00035	104
12313	.00000	.00001	.00003	.00002	.00003	.00002	.00003	.00001	.00000	.00015	185
12319	.00000	.00002	.00007	.00009	.00004	.00005	.00007	.00003	.00000	.00035	105
12316	.00000	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00006	268
12317	.00000	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00006	269
12318	.00000	.00001	.00003	.00002	.00003	.00002	.00003	.00001	.00000	.00015	181
12314	.00000	.00001	.00004	.00003	.00004	.00003	.00004	.00002	.00000	.00021	191
12310	.00000	.00008	.00024	.00017	.00023	.00017	.00025	.00009	.00000	.00173	47
12342	.00000	.00003	.00008	.00006	.00008	.00006	.00006	.00003	.00000	.00042	96
12343	.00000	.00006	.00020	.00014	.00019	.00014	.00021	.00008	.00000	.00102	54
12344	.00000	.00001	.00003	.00002	.00003	.00002	.00003	.00001	.00000	.00015	183
13111	.00002	.00017	.00010	.00006	.00006	.00006	.00004	.00025	.00035	.00115	90
13112	.00000	.00003	.00002	.00001	.00001	.00001	.00002	.00005	.00007	.00022	148
13121	.00000	.00002	.00001	.00001	.00001	.00001	.00001	.00002	.00003	.00012	207
13141	.00000	.00001	.00000	.00000	.00000	.00000	.00000	.00001	.00001	.00003	272
13142	.00000	.00004	.00003	.00002	.00002	.00002	.00002	.00006	.00004	.00025	134
13143	.00001	.00019	.00004	.00002	.00002	.00002	.00003	.00025	.00015	.00069	71
13144	.00000	.00003	.00003	.00002	.00002	.00002	.00002	.00006	.00001	.00021	149
13145	.00000	.00002	.00001	.00001	.00001	.00001	.00001	.00004	.00001	.00012	203
13152	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
13153	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
13199	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
13210	.00000	.00004	.00002	.00001	.00001	.00001	.00002	.00006	.00008	.00025	133
13211	.00002	.00018	.00011	.00007	.00007	.00007	.00009	.00037	.00039	.00137	45
13212	.00000	.00002	.00001	.00001	.00001	.00001	.00001	.00005	.00005	.00017	186
13214	.00000	.00001	.00000	.00000	.00000	.00000	.00000	.00001	.00002	.00006	286
13219	.00000	.00001	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00004	289
13210	.00000	.00003	.00002	.00001	.00001	.00001	.00002	.00009	.00006	.00026	124
13232	.00000	.00002	.00001	.00001	.00001	.00001	.00001	.00002	.00003	.00012	204
13234	.00001	.00012	.00007	.00004	.00004	.00004	.00006	.00024	.00024	.00086	59
13317	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
13321	.00000	.00002	.00001	.00001	.00001	.00001	.00001	.00004	.00005	.00018	180
13341	.00000	.00004	.00000	.00000	.00000	.00000	.00000	.00006	.00001	.00011	211
13343	.00000	.00006	.00000	.00000	.00000	.00000	.00000	.00008	.00002	.00016	179
13346	.00000	.00001	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00002	317
13347	.00002	.00119	.00000	.00000	.00000	.00000	.00000	.00156	.00032	.00309	21
1334A	.00000	.00001	.00000	.00000	.00000	.00000	.00000	.00002	.00000	.00003	291
1334L	.00000	.00003	.00000	.00000	.00000	.00000	.00000	.00003	.00001	.00007	288
13410	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
13422	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
13423	.00000	.00004	.00002	.00001	.00001	.00001	.00002	.00006	.00008	.00025	135
13911	.00000	.00002	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00003	293
13919	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
13918	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
1391M	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
13912	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
14119	.00000	.00008	.00009	.00004	.00008	.00008	.00012	.00010	.00000	.00063	78
14117	.00000	.00002	.00001	.00001	.00001	.00001	.00001	.00003	.00000	.00010	218
14118	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	244
14210	.00000	.00004	.00003	.00003	.00003	.00003	.00004	.00005	.00000	.00025	136
14221	.00000	.00004	.00001	.00001	.00001	.00001	.00001	.00005	.00000	.00014	192
14223	.00000	.00001	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00002	314
14240	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
14262	.00000	.00005	.00002	.00001	.00001	.00001	.00002	.00006	.00000	.00018	165
14269	.00000	.00001	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00002	313
14311	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	245
14312	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	246
14313	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	247
14321	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	243
14324	.00000	.00003	.00003	.00003	.00003	.00003	.00004	.00003	.00000	.00022	147
14332	.00000	.00009	.00010	.00004	.00009	.00009	.00013	.00012	.00000	.00070	69
14337	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00001	.00000	.00002	315
1433M	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
14410	.00000	.00001	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00002	316
14423	.00000	.00028	.00008	.00005	.00005	.00005	.00007	.00027	.00000	.00079	82
14428	.00000	.00005	.00001	.00000	.00000	.00000	.00001	.00005	.00001	.00013	193
1442E	.00000	.00004	.00000	.00000	.00000	.00000	.00000	.00004	.00000	.00008	241
1443E	.00000	.00002	.00000	.00000	.00000	.00000	.00000	.00003	.00000	.00005	273
14439	.00000	.00002	.00001	.00001	.00001	.00001	.00001	.00003	.00000	.00010	217
14900	.00032	.00039	.00042	.00036	.00039	.00038	.00059	.00049	.00065	.00395	15
14910	.00008	.00010	.00011	.00009	.00010	.00010	.00015	.00013	.00017	.00103	97
14920	.00005	.00006	.00006	.00005	.00006	.00005	.00008	.00007	.00009	.00057	80
14940	.00024	.00029	.00031	.00024	.00029	.00028	.00041	.00036	.00048	.00292	26
14992	.00002	.00002	.00002	.00002	.00002	.00002	.00004	.00004	.00004	.00024	139
14993	.00018	.00021	.00023	.00020	.00021	.00021	.00030	.00027	.00036	.00217	30
14998	.00076	.00091	.00099	.00084	.00092	.00091	.00131	.00119	.00153	.00932	4
14999	.00002	.00002	.00002	.00002	.00002	.00002	.00003	.00002	.00003	.00020	159
14997	.00002	.00003	.00003	.00003	.00003	.00003	.00004	.00003	.00005	.00029	117
14998	.00000	.00004	.00000	.00000	.00000	.00000	.00005	.00006	.00000	.00015	182
1499F	.00001	.00022	.00001	.00001	.00001	.00001	.00017	.00043	.00002	.00089	58
1499M	.00001	.00001	.00001	.00001	.00001	.00001	.00002	.00002	.00002	.00012	208
1499J	.00000	.00005	.00000	.00000	.00000	.00000	.00006	.00007	.00000	.00018	184
14010	.00000	.00000	.00000	.00000	.00001	.00001	.00003	.00002	.00000	.00007	249
14011	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00001	.00000	.00002	311
14021	.00000	.00000	.00000	.00000	.00001	.00001	.00002	.00002	.00000	.00006	267

VUL	CRITICALITIES BY FLIGHT PHASE PH1	PH2	PH3	PH4	PH5	PH6	PH7	PH8	PH9	TOTAL CRIT	CRIT RANK
14023	.00000	.00000	.00000	.00000	.00002	.00002	.00004	.00004	.00000	.00012	209
14027	.00000	.00000	.00000	.00000	.00005	.00005	.00013	.00017	.00000	.00040	100
1402A	.00000	.00000	.00000	.00000	.00003	.00003	.00009	.00012	.00000	.00027	123
14028	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00000	.00001	323
14031	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
14011	.00004	.00005	.00005	.00004	.00005	.00005	.00007	.00006	.00004	.00049	88
14012	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00002	.00010	219
14014	.00002	.00003	.00003	.00003	.00003	.00003	.00004	.00003	.00005	.00029	118
14015	.00002	.00003	.00003	.00003	.00003	.00003	.00004	.00003	.00005	.00029	119
14018	.00012	.00014	.00015	.00013	.00014	.00014	.00020	.00017	.00023	.00142	43
14010	.00008	.00010	.00011	.00009	.00010	.00010	.00015	.00013	.00017	.00103	93
14022	.00012	.00015	.00016	.00014	.00015	.00015	.00021	.00019	.00025	.00192	38
14023	.00012	.00015	.00016	.00014	.00015	.00015	.00021	.00019	.00025	.00192	39
23A114U	.00005	.00006	.00004	.00003	.00004	.00006	.00004	.00005	.00005	.00042	95
23A113U	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00009	230
23A300U	.00002	.00002	.00002	.00001	.00001	.00003	.00002	.00002	.00002	.00017	167
23A430U	.00000	.00001	.00000	.00000	.00000	.00001	.00000	.00000	.00000	.00002	312
23A434U	.00000	.00023	.00016	.00012	.00014	.00024	.00014	.00017	.00000	.00122	48
23A440U	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00009	249
23A444U	.00003	.00007	.00005	.00004	.00004	.00007	.00005	.00005	.00004	.00044	94
23A447U	.00002	.00002	.00002	.00001	.00001	.00003	.00002	.00002	.00002	.00017	168
23A447I	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00009	226
23A448U	.00002	.00002	.00002	.00001	.00001	.00003	.00002	.00002	.00002	.00017	169
23A44N1	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00009	227
23A448Z	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00009	228
23A499U	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00009	229
23A5200	.00004	.00005	.00003	.00003	.00003	.00005	.00003	.00004	.00004	.00034	106
23A611U	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
23A620U	.00067	.00087	.00063	.00048	.00053	.00072	.00063	.00067	.00077	.00617	6
23A621U	.00015	.00019	.00014	.00011	.00012	.00020	.00014	.00015	.00017	.00137	44
23A63	.00016	.00020	.00015	.00011	.00012	.00021	.00015	.00016	.00018	.00144	42
23A69	.00000	.00004	.00002	.00001	.00001	.00002	.00001	.00001	.00000	.00012	205
23A67	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	250
23A6A	.00037	.00048	.00034	.00026	.00029	.00050	.00034	.00037	.00042	.00337	20
23A710U	.00000	.00005	.00003	.00002	.00002	.00004	.00002	.00002	.00000	.00020	198
23A712U	.00000	.00001	.00001	.00000	.00001	.00001	.00001	.00000	.00000	.00005	277
23A714U	.00000	.00006	.00003	.00002	.00003	.00005	.00003	.00002	.00000	.00024	138
23A73	.00000	.00004	.00003	.00002	.00002	.00004	.00003	.00003	.00000	.00021	190
23A78	.00000	.00002	.00002	.00001	.00001	.00002	.00002	.00002	.00000	.00012	206
23A81	.00002	.00004	.00003	.00002	.00002	.00004	.00003	.00003	.00003	.00024	145
23A87U	.00000	.00005	.00003	.00003	.00003	.00005	.00003	.00003	.00000	.00025	137
23A88	.00010	.00013	.00009	.00007	.00008	.00014	.00009	.00010	.00012	.00092	57
23AV1	.00003	.00004	.00003	.00002	.00002	.00004	.00003	.00003	.00003	.00027	124
23AV2	.00006	.00007	.00005	.00004	.00004	.00006	.00005	.00006	.00006	.00051	86
23AV3	.00052	.00067	.00048	.00037	.00041	.00070	.00048	.00052	.00059	.00474	11
23AA1	.00003	.00004	.00003	.00002	.00002	.00004	.00003	.00003	.00003	.00027	122
23AA4	.00008	.00011	.00008	.00006	.00007	.00011	.00008	.00008	.00010	.00077	66
23AA5	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00000	.00000	.00001	322
23A8100	.00001	.00002	.00001	.00001	.00001	.00002	.00001	.00001	.00002	.00012	207
29311	.00010	.00024	.00017	.00013	.00015	.00025	.00017	.00018	.00021	.00160	35
29312	.00011	.00019	.00012	.00009	.00010	.00018	.00012	.00012	.00015	.00118	49
29310	.00014	.00016	.00011	.00009	.00009	.00016	.00011	.00012	.00014	.00110	91
29311	.00023	.00030	.00022	.00016	.00018	.00031	.00022	.00023	.00027	.00212	32
29A11	.00000	.00001	.00001	.00000	.00000	.00001	.00001	.00001	.00000	.00005	271
29A1G	.00001	.00002	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00010	220
29A1H	.00000	.00002	.00001	.00000	.00000	.00001	.00001	.00001	.00000	.00006	266
29C11	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	294
29C14	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	294
29C15	.00010	.00013	.00009	.00007	.00008	.00014	.00009	.00010	.00012	.00092	58
29C17	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00001	324
91111	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
91112	.00000	.00000	.00001	.00001	.00002	.00001	.00001	.00000	.00000	.00006	261
91113	.00000	.00000	.00003	.00004	.00008	.00005	.00003	.00000	.00000	.00023	143
91115	.00000	.00000	.00003	.00004	.00009	.00005	.00004	.00000	.00000	.00025	132
91117	.00000	.00000	.00000	.00000	.00001	.00001	.00000	.00000	.00000	.00002	309
9111B	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
9111M	.00000	.00000	.00000	.00001	.00001	.00001	.00001	.00000	.00000	.00004	286
9111C	.00000	.00000	.00000	.00000	.00001	.00000	.00000	.00000	.00000	.00001	325
9111D	.00000	.00000	.00000	.00000	.00001	.00000	.00000	.00000	.00000	.00001	326
9111P	.00000	.00000	.00000	.00000	.00001	.00000	.00000	.00000	.00000	.00001	327
9111M	.00000	.00000	.00000	.00000	.00001	.00000	.00000	.00000	.00000	.00001	328
9111J	.00000	.00000	.00002	.00003	.00005	.00003	.00002	.00000	.00000	.00015	189
9111L	.00000	.00000	.00001	.00002	.00003	.00002	.00001	.00000	.00000	.00009	254
9111N	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
9111R	.00000	.00000	.00002	.00003	.00007	.00004	.00003	.00000	.00000	.00019	182
9112U	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
9112J	.00000	.00000	.00000	.00001	.00003	.00002	.00000	.00000	.00000	.00006	260
9112A	.00000	.00000	.00000	.00001	.00002	.00001	.00000	.00000	.00000	.00004	285
9112B	.00000	.00000	.00008	.00014	.00029	.00017	.00009	.00000	.00000	.00077	65
9112R	.00000	.00000	.00000	.00000	.00001	.00001	.00000	.00000	.00000	.00002	310
9112T	.00000	.00000	.00000	.00001	.00002	.00001	.00000	.00000	.00000	.00004	283
9112U	.00000	.00000	.00001	.00001	.00003	.00001	.00001	.00000	.00000	.00007	291
9112N	.00000	.00000	.00002	.00008	.00014	.00008	.00002	.00000	.00000	.00036	102
9112C	.00000	.00000	.00000	.00001	.00001	.00001	.00000	.00000	.00000	.00003	297
9112D	.00000	.00000	.00001	.00001	.00003	.00001	.00001	.00000	.00000	.00007	292
9112E	.00000	.00000	.00004	.00010	.00020	.00010	.00005	.00000	.00000	.00049	90
9112F	.00000	.00000	.00002	.00003	.00006	.00005	.00003	.00000	.00000	.00021	154
9113Z	.00002	.00009	.00012	.00010	.00022	.00013	.00019	.00019	.00003	.00101	95
9113J	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
9113A	.00000	.00001	.00001	.00001	.00002	.00001	.00001	.00001	.00000	.00008	239
9113B	.00000	.00000	.00001	.00000	.00001	.00001	.00001	.00001	.00000	.00005	275
9114I	.00000	.00000	.00000	.00000	.00001	.00000	.00001	.00001	.00000	.00003	298
9114Z	.00000	.00002	.00002	.00002	.00005	.00003	.00003	.00003	.00000	.00020	155
9114J	.00000	.00000	.00000	.00000	.00001	.00001	.00001	.00001	.00000	.00004	284
9114S	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
9114T	.00000	.00001	.00002	.00002	.00004	.00002	.00003	.00003	.00000	.00017	172
9114B	.00001	.00006	.00009	.00008	.00017	.00010	.00011	.00011	.00002	.00075	67
9114A	.00000	.00000	.00000	.00000	.00001	.00001	.00001	.00001	.00000	.00004	282

VUC	CRITICALITIES BY FLIGHT PHASE									TOTAL CRIT	CRIT RANK
	PH1	PH2	PH3	PH4	PH5	PH6	PH7	PH8	PH9		
*1140	.00000	.00001	.00002	.00001	.00003	.00002	.00002	.00002	.00000	.00013	197
*1142	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*1153	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*1211	.00000	.00000	.00001	.00001	.00002	.00001	.00001	.00000	.00000	.00006	204
*1213	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*1219	.00000	.00000	.00000	.00001	.00001	.00001	.00000	.00000	.00000	.00003	299
*1210	.00000	.00000	.00004	.00011	.00024	.00014	.00009	.00000	.00000	.00044	76
*1231	.00001	.00002	.00002	.00001	.00002	.00001	.00002	.00002	.00002	.00015	168
*1232	.00002	.00002	.00002	.00002	.00004	.00002	.00002	.00003	.00003	.00022	145
*1230	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00009	232
*131E	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*1313	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*1316	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*131A	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*1310	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*1311	.00000	.00000	.00001	.00001	.00002	.00001	.00001	.00000	.00000	.00006	262
*1321	.00000	.00003	.00000	.00000	.00000	.00000	.00003	.00003	.00000	.00009	233
*1323	.00000	.00001	.00000	.00000	.00000	.00000	.00001	.00001	.00000	.00003	300
*1331	.00000	.00002	.00000	.00000	.00000	.00000	.00002	.00002	.00000	.00006	263
*1333	.00000	.00011	.00000	.00000	.00000	.00000	.00011	.00013	.00000	.00035	103
*1330	.00000	.00001	.00000	.00000	.00000	.00000	.00001	.00001	.00000	.00003	299
*1337	.00000	.00004	.00000	.00000	.00000	.00000	.00004	.00005	.00000	.00013	199
*1338	.00000	.00005	.00000	.00000	.00000	.00000	.00005	.00007	.00000	.00017	171
*1341	.00000	.00004	.00000	.00000	.00000	.00000	.00004	.00005	.00000	.00013	196
*1342	.00000	.00009	.00000	.00000	.00000	.00000	.00009	.00011	.00000	.00029	115
*1347	.00000	.00007	.00000	.00000	.00000	.00000	.00007	.00009	.00000	.00023	144
*1348	.00000	.00003	.00000	.00000	.00000	.00000	.00003	.00003	.00000	.00009	231
*134B	.00000	.00005	.00000	.00000	.00000	.00000	.00005	.00007	.00000	.00017	170
*1351	.00003	.00004	.00004	.00003	.00006	.00004	.00004	.00005	.00006	.00039	101
*1352	.00025	.00031	.00032	.00022	.00047	.00028	.00032	.00038	.00044	.00299	24
*1711	.00000	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00006	265
*2111	.00001	.00007	.00014	.00008	.00007	.00003	.00019	.00008	.00001	.00066	77
*2112	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*2121	.00049	.00190	.00170	.00096	.00074	.00032	.00211	.00118	.00082	.00982	3
*2122	.00003	.00007	.00008	.00004	.00003	.00001	.00009	.00005	.00005	.00045	91
*2125	.00001	.00001	.00002	.00001	.00001	.00000	.00002	.00001	.00001	.00010	216
*2127	.00036	.00085	.00097	.00055	.00042	.00018	.00121	.00067	.00060	.00581	7
*2128	.00005	.00012	.00013	.00006	.00006	.00002	.00017	.00009	.00008	.00080	61
*212D	.00001	.00001	.00002	.00001	.00001	.00000	.00002	.00001	.00001	.00010	219
*212M	.00000	.00001	.00001	.00000	.00000	.00000	.00001	.00001	.00000	.00004	287
*212N	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*2131	.00001	.00003	.00003	.00002	.00001	.00001	.00004	.00002	.00002	.00017	183
*213B	.00000	.00001	.00001	.00001	.00000	.00000	.00001	.00001	.00000	.00005	274
*2141	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*2143	.00002	.00004	.00005	.00003	.00002	.00001	.00006	.00003	.00003	.00029	118
*2151	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*2152	.00000	.00000	.00003	.00003	.00003	.00001	.00005	.00000	.00000	.00015	190
*2210	.00023	.00071	.00081	.00045	.00039	.00019	.00100	.00056	.00039	.00465	12
*4111	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4112	.00011	.00013	.00017	.00013	.00017	.00017	.00020	.00026	.00026	.00154	37
*4113	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4114	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4115	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4116	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4117	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4118	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*411M	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*411L	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4110	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*411E	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*411F	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4116	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*411M	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*411J	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*411L	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*411M	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*411N	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*411P	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4121	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4127	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4128	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4124	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4213	.00001	.00001	.00001	.00001	.00001	.00001	.00002	.00002	.00002	.00014	198
*4219	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4217	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00006	240
*4220	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4221	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4222	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4223	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4224	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4225	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4227	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4228	.00000	.00000	.00000	.00007	.00008	.00009	.00010	.00007	.00000	.00041	99
*4231	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*4232	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*5112	.00000	.00007	.00009	.00007	.00013	.00012	.00012	.00014	.00000	.00069	72
*5113	.00000	.00002	.00003	.00003	.00001	.00003	.00003	.00005	.00000	.00020	197
*5114	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00001	329
*5115	.00000	.00002	.00003	.00003	.00001	.00004	.00004	.00006	.00000	.00023	142
*5117	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00001	330
*5118	.00000	.00000	.00001	.00001	.00000	.00001	.00001	.00001	.00000	.00005	278
*5122	.00000	.00006	.00008	.00008	.00003	.00010	.00010	.00014	.00000	.00059	79
*5123	.00000	.00004	.00006	.00006	.00002	.00007	.00007	.00010	.00000	.00042	97
*5124	.00000	.00001	.00001	.00001	.00000	.00001	.00001	.00001	.00000	.00006	259
*5125	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
*512A	.00000	.00003	.00004	.00004	.00001	.00005	.00005	.00007	.00000	.00029	114
*5134	.00001	.00000	.00001	.00001	.00000	.00001	.00001	.00001	.00002	.00008	238
*5135	.00002	.00001	.00001	.00001	.00000	.00002	.00002	.00002	.00004	.00015	187

NUC	CRITICALITIES BY FLIGHT PHASE PH1	PH2	PH3	PH4	PH5	PH6	PH7	PH8	PH9	TOTAL CRIT	CRIT RANK
49134	.00011	.00004	.00004	.00004	.00002	.00004	.00004	.00011	.00019	.00077	64
4913C	.00096	.00025	.00038	.00034	.00013	.00051	.00051	.00064	.00101	.00437	13
4913D	.00007	.00003	.00004	.00004	.00001	.00005	.00004	.00007	.00012	.00049	89
4913E	.00002	.00002	.00002	.00002	.00000	.00003	.00003	.00005	.00005	.00024	141
49211	.00003	.00001	.00001	.00001	.00000	.00002	.00002	.00002	.00000	.00009	237
49219	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4921B	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4921A	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4921B	.00000	.00000	.00001	.00001	.00000	.00001	.00001	.00001	.00000	.00005	277
4921C	.00000	.00003	.00007	.00004	.00003	.00010	.00010	.00013	.00000	.00050	83
4921E	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4921F	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
49216	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
49212	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
49221	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4922700	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4922C	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
46111	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
46112	.00000	.00004	.00004	.00004	.00003	.00003	.00003	.00004	.00000	.00027	141
46118	.00000	.00003	.00003	.00003	.00002	.00002	.00003	.00003	.00000	.00019	161
46121	.00000	.00000	.00001	.00001	.00000	.00000	.00000	.00000	.00000	.00002	307
46122	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	254
4613100	.00000	.00004	.00004	.00004	.00002	.00002	.00004	.00004	.00000	.00024	140
46133	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
46139	.00000	.00003	.00003	.00003	.00002	.00002	.00003	.00003	.00000	.00019	160
46137	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	293
46142	.00000	.00001	.00000	.00002	.00001	.00001	.00002	.00002	.00000	.00009	236
46144	.00000	.00000	.00000	.00001	.00001	.00001	.00001	.00001	.00000	.00005	278
46148	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4614D	.00000	.00004	.00004	.00004	.00002	.00003	.00004	.00004	.00000	.00025	131
4614E	.00000	.00013	.00011	.00011	.00007	.00008	.00011	.00012	.00000	.00073	68
46153	.00000	.00000	.00000	.00001	.00001	.00001	.00001	.00001	.00000	.00005	279
46161	.00000	.00004	.00004	.00004	.00003	.00003	.00004	.00004	.00000	.00028	127
46162	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	255
46164	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	256
46167	.00000	.00009	.00009	.00009	.00006	.00006	.00009	.00009	.00000	.00059	81
46171	.00000	.00036	.00036	.00037	.00024	.00024	.00035	.00030	.00000	.00222	49
46172	.00000	.00000	.00000	.00000	.00004	.00004	.00000	.00000	.00000	.00014	191
46211	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
46212	.00000	.00000	.00001	.00001	.00000	.00000	.00000	.00000	.00000	.00002	308
46219	.00000	.00002	.00002	.00002	.00001	.00001	.00002	.00001	.00000	.00011	213
4621B	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4621D	.00000	.00004	.00004	.00004	.00002	.00002	.00003	.00003	.00000	.00022	144
46221	.00000	.00000	.00000	.00003	.00002	.00002	.00002	.00002	.00000	.00011	212
46222	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
46223	.00000	.00000	.00000	.00004	.00003	.00003	.00004	.00003	.00000	.00017	173
46229	.00000	.00000	.00000	.00005	.00003	.00003	.00005	.00004	.00000	.00020	156
4622A	.00000	.00002	.00002	.00004	.00003	.00003	.00004	.00003	.00000	.00021	151
46227	.00000	.00000	.00001	.00001	.00000	.00000	.00000	.00000	.00000	.00002	305
4622A	.00000	.00012	.00014	.00014	.00008	.00008	.00012	.00010	.00000	.00078	51
46231	.00000	.00000	.00014	.00014	.00000	.00000	.00000	.00000	.00000	.00028	142
46232	.00000	.00040	.00040	.00040	.00027	.00027	.00038	.00033	.00000	.00245	47
46233	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00001	300
4631100	.00000	.00000	.00000	.00087	.00058	.00058	.00087	.00068	.00000	.00358	18
46312	.00000	.00000	.00000	.00001	.00001	.00001	.00001	.00001	.00000	.00005	308
46313	.00000	.00000	.00000	.00003	.00002	.00002	.00003	.00002	.00000	.00012	199
46314	.00000	.00000	.00000	.00017	.00011	.00011	.00017	.00013	.00000	.00069	73
46316	.00000	.00000	.00000	.00003	.00002	.00002	.00003	.00002	.00000	.00012	201
4631C	.00000	.00000	.00000	.00004	.00003	.00003	.00004	.00003	.00000	.00017	174
46417	.00000	.00004	.00004	.00004	.00003	.00003	.00004	.00004	.00000	.00027	142
46431	.00000	.00010	.00011	.00011	.00007	.00007	.00011	.00012	.00000	.00069	74
46432	.00000	.00004	.00004	.00004	.00003	.00003	.00004	.00004	.00000	.00026	148
46433	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00000	.00001	333
47111	.00000	.00000	.00034	.00049	.00100	.00043	.00042	.00000	.00000	.00274	45
47112	.00000	.00000	.00003	.00005	.00011	.00007	.00004	.00000	.00000	.00030	113
47113	.00000	.00000	.00000	.00000	.00001	.00000	.00000	.00000	.00000	.00001	334
47116	.00000	.00000	.00000	.00001	.00001	.00001	.00000	.00000	.00000	.00003	302
47117	.00000	.00000	.00010	.00008	.00010	.00010	.00010	.00000	.00000	.00055	82
47212	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
47213	.00000	.00000	.00000	.00001	.00001	.00001	.00000	.00000	.00000	.00003	305
47219	.00000	.00000	.00002	.00006	.00012	.00007	.00003	.00000	.00000	.00030	112
4721B	.00000	.00000	.00001	.00003	.00006	.00004	.00001	.00000	.00000	.00015	186
4721A	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
4721C	.00000	.00000	.00001	.00002	.00004	.00002	.00001	.00000	.00000	.00010	214
4721F	.00000	.00000	.00002	.00002	.00004	.00004	.00002	.00000	.00000	.00014	177
47210	.00000	.00000	.00000	.00000	.00001	.00001	.00000	.00000	.00000	.00002	304
4721M	.00000	.00000	.00002	.00003	.00010	.00006	.00002	.00000	.00000	.00023	130
4721N	.00000	.00000	.00011	.00026	.00039	.00035	.00014	.00000	.00000	.00147	41
47221	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
47227	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
47112	.00032	.00045	.00046	.00033	.00047	.00032	.00053	.00058	.00039	.00405	14
49122	.00018	.00025	.00026	.00018	.00026	.00018	.00030	.00032	.00033	.00226	48
51111	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51112	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51113	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51114	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51119	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
5111M	.00000	.00000	.00001	.00002	.00002	.00002	.00002	.00000	.00000	.00009	235
5111C	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
5111F	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51132	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51136	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51142	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51211	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51212	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
51411	.00000	.00071	.00015	.00010	.00015	.00010	.00017	.00009	.00000	.00147	41
51412	.00000	.00020	.00004	.00003	.00004	.00003	.00005	.00003	.00000	.00042	94
51423	.00000	.00270	.00142	.00102	.00144	.00099	.00164	.00000	.00000	.00921	5

	CRITICALITIES BY FLIGHT PHASE									TOTAL	CRIT
WUC	PH1	PH2	PH3	PH4	PH5	PH6	PH7	PH8	PH9	CRIT	RANK
91[illegible]	.00002	.00004	.00008	.00003	.00008	.00005	.00004	.00005	.00004	.00033	84
91[illegible]	.00000	.00000	.00000	.00000	.00000	.00000	.00006	.00001	.00000	.00001	321
91[illegible]	.00049	.00043	.00045	.00048	.00048	.00045	.00074	.00081	.00082	.00507	9
91[illegible]	.00018	.00014	.00015	.00018	.00018	.00018	.00017	.00018	.00019	.00128	46
91[illegible]	.00043	.00043	.00045	.00044	.00047	.00045	.00079	.00081	.00083	.00370	8
91[illegible]	.00035	.00035	.00037	.00026	.00037	.00026	.00042	.00046	.00047	.00321	21
91021	.00008	.00004	.00001	.00008	.00008	.00008	.00006	.00004	.00000	.00013	174
91022	.00000	.00002	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00003	301
91023	.00000	.00002	.00001	.00000	.00000	.00000	.00000	.00001	.00000	.00004	281
91024	.00000	.00003	.00002	.00001	.00001	.00001	.00001	.00005	.00000	.00010	178
91025	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00001	332
91027	.00000	.00003	.00000	.00000	.00000	.00000	.00045	.00081	.00000	.00189	54
91028	.00000	.00010	.00000	.00000	.00000	.00000	.00007	.00014	.00000	.00031	111
91024	.00000	.00000	.00001	.00000	.00000	.00000	.00000	.00001	.00000	.00002	304
91037	.00000	.00005	.00005	.00003	.00005	.00003	.00004	.00006	.00000	.00033	108
91712	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00001	.00000	.00002	318
91714	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00001	319
91811	.00000	.00004	.00005	.00003	.00005	.00003	.00003	.00006	.00000	.00031	110
91812	.00000	.00001	.00001	.00001	.00001	.00001	.00002	.00002	.00000	.00009	223
91813	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	298
91814	.00000	.00001	.00001	.00001	.00001	.00001	.00002	.00002	.00000	.00009	222
91819	.00000	.00002	.00002	.00001	.00002	.00001	.00002	.00002	.00000	.00012	210
91816	.00000	.00001	.00001	.00001	.00002	.00001	.00002	.00002	.00000	.00010	221
91821	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00000	.00001	320
91822	.00000	.00001	.00001	.00001	.00001	.00001	.00002	.00002	.00000	.00009	224
91823	.00000	.00001	.00001	.00001	.00001	.00001	.00001	.00001	.00000	.00007	297
91842	.00005	.00000	.00000	.00001	.00004	.00004	.00008	.00010	.00000	.00032	109
91843	.00003	.00000	.00000	.00001	.00002	.00002	.00004	.00005	.00000	.00017	179
91844	.00041	.00000	.00000	.00013	.00045	.00049	.00091	.00110	.00000	.00369	17
91849	.00000	.00018	.00012	.00008	.00012	.00008	.00013	.00011	.00000	.00082	80
91850	.00000	.00015	.00010	.00007	.00010	.00007	.00011	.00009	.00000	.00069	75
91897	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
91951	.00000	.00000	.00048	.00038	.00052	.00037	.00080	.00000	.00000	.00345	19
91952	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
91954	.00000	.00000	.00000	.00001	.00001	.00001	.00001	.00000	.00000	.00004	290
91955	.00000	.00000	.00000	.00000	.00001	.00000	.00000	.00000	.00000	.00001	321
96280	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
96490	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
96881	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
96883	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
97000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
97112	.00025	.00033	.00050	.00034	.00025	.00004	.00050	.00050	.00042	.00317	42
97114[illegible]	.00321	.00430	.00447	.00431	.00322	.00107	.00645	.00644	.00536	.04083	1
97119	.00041	.00059	.00083	.00056	.00042	.00014	.00083	.00083	.00069	.00528	10
97116	.00031	.00041	.00042	.00041	.00031	.00010	.00062	.00062	.00052	.00392	14
97117	.00012	.00017	.00025	.00017	.00013	.00004	.00025	.00025	.00021	.00159	36
9711A	.00004	.00005	.00008	.00005	.00004	.00001	.00008	.00008	.00007	.00050	87
9711B	.00015	.00020	.00010	.00020	.00015	.00005	.00030	.00030	.00025	.00190	33
9711F	.00001	.00002	.00003	.00002	.00001	.00000	.00003	.00003	.00002	.00017	176
9711L	.00003	.00004	.00005	.00004	.00003	.00001	.00005	.00005	.00004	.00034	107
9334100	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
9712D	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
9712E	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
9712F	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
9712H	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
71740	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
7[illegible]C2	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
73110	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
73124	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
73490	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
74984	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
74988	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
93111	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
93112	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
93114	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
93211	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
93213	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	
93214	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	

APPENDIX E

MISSION CRITICALITY MODELS

APPENDIX E
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APPENDIX E

E.1 MODEL DERIVATION

In this appendix, models are presented for combining phase sensitivity and reliability values into an overall measure of element criticality. The basic model for the combining process is as follows:

$$P(\mathcal{A}, \bar{X}) = \sum_{k=1}^{n} P(\bar{X}_k, \phi_k)\, P(\mathcal{A}_k | \bar{X}_k) = \sum_{k=1}^{n} P(\bar{X}_k, \phi_k)\, S_k$$

where: n is the number of phases;

$P(\mathcal{A}, \bar{X})$ is the overall criticality of element X;

$P(\bar{X}_k, \phi_k)$ is the probability that element X will be failed in the k^{th} phase;

$P(\mathcal{A}_k | \bar{X}_k)$ is the sensitivity of element X in the k^{th} phase (S_k), i.e., the probability of accident in phase k given X that is failed in that phase.

The quantity $P(\bar{X}_k, \phi_k)$ represents the joint occurrence of failure of the X^{th} element and occurrence of the phase. If, for example, phase 3 were being considered and X had in fact failed in phase 2, the event $(\bar{X}_3, \phi_3)$ will occur if no accident resulted in phase 2 and a decision was made to proceed to phase 3 (either knowing that X was failed or not knowing such failure took place). The no-accident occurrence probability is simply the complement of the phase sensitivity of the element. Given element failure, however, a phase-transition-probability matrix must also be considered.

If $P(\bar{X}'_k)$ represents the probability that X first fails in the k^{th} phase, the overall criticality (assuming a 3-phase mission) can be expressed as follows:

$$\begin{aligned} P(\mathcal{A}, \bar{X}) = {} & P(\bar{X}'_1) \{S_1 + (1-S_1)\, P(1,2|\bar{X}_1, \bar{\mathcal{A}}) [S_2 + (1-S_2)\, P(2,3|\bar{X}_2, \bar{\mathcal{A}}) S_3]\} \\ & + (1-S_1)\, P(1,3\, \bar{X}_1, \bar{\mathcal{A}}) S_3 \\ & + P(\bar{X}'_2) \{S_2 + (1-S_2)\, P(2,3|\bar{X}_2, \bar{\mathcal{A}}) S_3\} \\ & + P(\bar{X}'_3) \{S_3\} \end{aligned}$$

where: $S_k = P(\mathcal{A}_k | \bar{X}_k)$ = sensitivity in phase k;

$P(i,j|\bar{X}_i, \bar{\mathcal{A}})$ is the probability of a transition from phase i to phase j, given that X is failed in the i^{th} phase and no accident occurs.

To explain this equation further, consider the second term,

$$P(\bar{X}_2')S_2 + P(\bar{X}_2')(1-S_2)\,P(2,3|\bar{X}_2,\bar{\mathcal{A}})S_3,$$

which represents the probability that either:

a. X first fails in phase 2 and an accident occurs, i.e., $P(\bar{X}_2')S_2$; or

b. X first fails in phase 2 but no accident occurs; and there is a transition to phase 3, in which an accident occurs, i.e.,

$$P(\bar{X}_2')(1-S_2)P(2,3|\bar{X}_2,\bar{\mathcal{A}})S_3.$$

By equating the coefficients of S_k in the two models for $P(\mathcal{A},\bar{X})$, we find the following equations for $P(\bar{X}_k,\phi_k)$:

$$P(\bar{X}_1,\phi_1) = P(\bar{X}_1')$$

$$P(\bar{X}_2,\phi_2) = P(\bar{X}_1')(1-S_1)P(1,2|\bar{X}_1,\bar{\mathcal{A}}) + P(\bar{X}_2')$$

$$P(\bar{X}_3,\phi_3) = P(\bar{X}_1')(1-S_1)\{P(1,2|\bar{X}_1,\bar{\mathcal{A}})(1-S_2)P(2,3|\bar{X}_2,\bar{\mathcal{A}}) + P(1,3|\bar{X}_1,\bar{\mathcal{A}})\}$$
$$+ P(\bar{X}_2')(1-S_2)P(2,3|\bar{X}_2,\bar{\mathcal{A}}) + P(\bar{X}_3')$$

Therefore the coefficient of the k^{th} sensitivity value in the basic overall mission criticality expressions is seen to be a function of the phase-dependent first-failure probabilities $P(\bar{X}_k')$; the phase transition probabilities given element failure but no accident $P(i,j|\bar{X}_i,\bar{\mathcal{A}})$; and the sensitivity value of the previous phase $(1-S_j)$.

A general expression for $P(\bar{X}_k,\phi_k)$, leading to a matrix formula for overall criticality, will now be developed. From straightforward considerations, we can write

$$P(\bar{X}_k,\phi_k) = \sum_{j=1}^{k} P(\bar{X}_j')P(\phi_k|\bar{X}_j)$$

where $P(\phi_k|\bar{X}_j)$ is the probability that phase k will be attempted, given X is failed in the j^{th} phase $[P(\phi_k|\bar{X}_k) = 1.0]$.

The conditional probabilities $P(\phi_k|\overline{X}_j)$ can be obtained recursively as follows:

$$P(\phi_k|\overline{X}_k) = 1.0$$

$$P(\phi_k|\overline{X}_{k-1}) = (1-S_{k-1})\,P(k-1, k|\overline{X}_{k-1}, \overline{\mathcal{A}})\,P(\phi_k|\overline{X}_k)$$

where: $(1-S_{k-1}) = 1 - P(\mathcal{A}|\overline{X}_k) = P(\overline{\mathcal{A}}|\overline{X}_k)$ = probability of no accident in the k^{th} phase, given X is failed in that phase.

In general,

$$P(\phi_k|\overline{X}_i) = (1-S_i) \sum_{j=i+1}^{k} P(i, j|\overline{X}_i, \overline{\mathcal{A}})\,P(\phi_k|\overline{X}_j)$$

For computer solution of mission criticality, three matrices can be set up and defined as follows:

$$\underline{P} = \left[P(\overline{X}_1)\ P(\overline{X}_2)\ \ldots\ P(\overline{X}_n) \right]$$

$$\underline{C} = \begin{pmatrix} 1.0 & P(\phi_2|\overline{X}_1) & P(\phi_3|\overline{X}_1) & P(\phi_4|\overline{X}_1) & \ldots & P(\phi_n|\overline{X}_1) \\ & 1.0 & P(\phi_3|\overline{X}_2) & P(\phi_4|\overline{X}_2) & \ldots & P(\phi_n|\overline{X}_2) \\ & & 1.0 & P(\phi_4|\overline{X}_3) & \ldots & P(\phi_n|\overline{X}_3) \\ & \underline{O} & & \cdot & \cdot & \cdot \\ & & & & 1.0 & P(\phi_n|\overline{X}_{n-1}) \\ & & & & & 1.0 \end{pmatrix}$$

$$\underline{S} = \begin{pmatrix} S_1 \\ S_2 \\ \cdot \\ \cdot \\ \cdot \\ S_n \end{pmatrix}$$

Then it is easily shown that the following matrix equation holds:

$$P(\mathcal{A}, \overline{X}) = \underline{P}\,\underline{C}\,\underline{S}$$

It is noted that $\underline{P}\,\underline{C}$ is a vector, say $(Q_1\ Q_2 \ldots Q_n)$, where

$$Q_j = P(\overline{X}_j, \phi_j)$$

E.2 EXAMPLE OF MODEL EXERCISE

Consider a three-phase mission of which 100 flights were made. The results, assuming only one possible element failure, are as follows:

	Phase: ϕ_1	ϕ_2	ϕ_3
Number of flights entering phase	100	90	90
Number of flight elements first failed in phase	20	10	5
Number of flights with element failed in phase	20	20	25
Number of transitions with element failure:			
ϕ_1 to ϕ_2	10	--	--
ϕ_1 to ϕ_3	15	--	--
ϕ_2 to ϕ_3	--	15	--
Number of accidents	5	5	8

A schematic representation of distribution of the 100 flights is shown in Figure E-1.

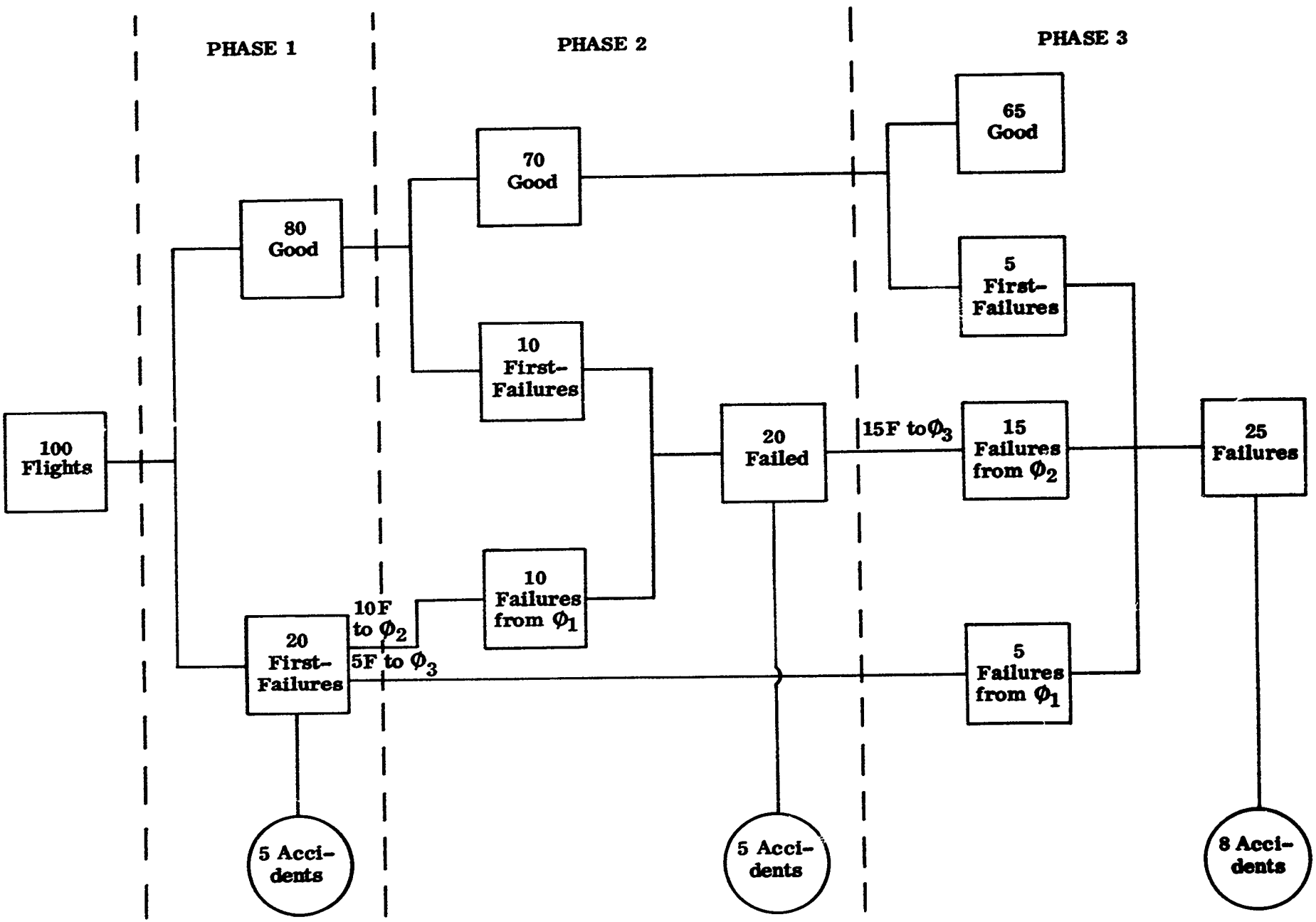

Figure E-1. Schematic Representation of Distribution of 100 Flights

In this example the following would be the observed values of various probability terms:

$$P(\mathcal{A}, \overline{X}) = \frac{18}{100} = 0.18$$

$$\underline{P} = (0.20\ 0.10\ 0.05)$$

$$\underline{S} = \begin{pmatrix} 0.25 \\ 0.25 \\ 0.32 \end{pmatrix}$$

and

$$P(1, 2|\overline{X}_1, \overline{\mathcal{A}}) = \frac{10}{15} = 2/3$$

$$P(1, 3|\overline{X}_1, \overline{\mathcal{A}}) = \frac{5}{15} = 1/3$$

$$P(2, 3|\overline{X}_2, \overline{\mathcal{A}}) = \frac{15}{15} = 1.0$$

$$P(\phi_2|\overline{X}_1) = \frac{10}{20} = 1/2$$

$$P(\phi_3|\overline{X}_1) = \frac{5+7.5}{20} = 5/8$$

$$P(\phi_3|\overline{X}_2) = \frac{15}{20} = 3/4$$

The last three probabilities also can be obtained from the model as follows:

$$P(\phi_2|\overline{X}_1) = (1-S_1)P(1, 2|\overline{X}_1, \overline{\mathcal{A}})P(\phi_2|\overline{X}_2)$$
$$= 3/4 \times 2/3 \times 1$$
$$= 1/2$$

$$P(\phi_3|\overline{X}_1) = (1-S_1)\{P(1, 2|\overline{X}_1, \overline{\mathcal{A}})P(\phi_3|\overline{X}_2) + P(1, 3|\overline{X}_1, \overline{\mathcal{A}})P(\phi_3|\overline{X}_3)\}$$
$$= 3/4\{2/3\ 3/4 + 1/3\}$$
$$= 3/4 \times 5/6 = 5/8$$

(Continued)

$$P(\phi_3|\overline{X}_2) = (1-S_2)P(2,3|\overline{X}_2,\mathcal{A})P(\phi_3|\overline{X}_3)$$

$$= (1-0.25)(1.0)(1.0) = 3/4$$

The $\underline{C}$ matrix is computed as:

$$\underline{C} = \begin{bmatrix} 1.0 & 1/2 & 5/8 \\ 0 & 1 & 3/4 \\ 0 & 0 & 1 \end{bmatrix}$$

and we have

$$P(\mathcal{A},\overline{X}) = (0.20 \quad 0.10 \quad 0.05) \begin{bmatrix} 1 & 1/2 & 5/8 \\ 0 & 1.0 & 3/4 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0.25 \\ 0.25 \\ 0.32 \end{bmatrix}$$

$$= (0.20 \quad 0 \quad 20 \quad 0.25) \begin{bmatrix} 0.25 \\ 0.25 \\ 0.32 \end{bmatrix} = 0.05 + 0.05 + 0.08 = 0.18.$$

The last matrix product is simply $\sum_{j=1}^{3} P(\overline{X}_j,\phi_j)S_j$, the basic model for accident probability.

Figure E-2 is computer program written in the BASIC language for solving for accident probability when the phase first-failure probability vector, the phase transition matrix, and phase sensitivity vector are read-in. Specific comments on the program are noted in the exhibit.

Figure E-3 is the computer printout for the sample problem discussed above.

E.3 CONDITIONS AND ASSUMPTIONS

Several conditions and assumptions implied by the models presented above are discussed in this section.

Condition 1: Only one element (or function) failure is generally considered. That is, the term $P(\mathcal{A},\overline{X})$ represents the criticality of element or function X, assuming that all other elements or functions not in a redundant or back-up mode are not failed. For elements in a redundant design, the sensitivity values have been obtained in a manner that does consider the possibility of failure of back-up elements. Failures of functions which depend on A, however, are considered through the link dependency analysis.

```
1 DIM S(10), T(10,10), P(10)
2 DIM C(10,10),X(1,10),Y(1,10),Z(1,1)
7 PRINT
8 PRINT"NO. OF PHASES AND NO. OF COMPONENTS ARE";
9INPUT N2,N3 ——  —— — —— — — — —— Keyboard inputs
11 LET D1=0
12 PRINT
13 LET D1=D1 + 1
14 PRINT"COMPONENT NO. IS"D1
15 PRINT
16 MAT C =ZER(N2,N2)
25 PRINT
26 PRINT"PHASE TRANSITION MATRIX"
27 PRINT
30 FOR I=1 TO N2-1
32 FOR J= I+1 TO N2
35 READ T(I,J)
36 PRINT "P(";I;J;") = "; T(I,J)
40 NEXT J
43 NEXT I
45 PRINT
46 PRINT "FIRST-FAIL PROBS"
47 PRINT
48 MAT READ P(N2) — — — — — — — — Read-in phase 1st Fail Prob. Vector (Line 610)
49 MAT PRINT P
52 PRINT
54 PRINT"PHASE SENSITIVITIES"
55 MAT READ S(N2) —— —— —— —— —— —— Read-in phase sensitivity vector (Line 620)
56 PRINT
58 MAT PRINT S
60 LET C(1,1)=1.0
62 PRINT "PROB. PHASE J OCCURS GIVEN FAILURE EXISTS IN PHASE K"
65 FOR J=2 TO N2
70 LET C(J,J)=1.0
75 FOR I=1 TO J-1
80 LET E=0
85 LET K= J-I
90 FOR M= K+1 TO J
95 LET E=E+T(K,M)*C(M,J)
100 NEXT M
105 LET C(K,J)=(1-S(K))*E
106 PRINT K;J;"C(K,J)";C(K,J)
110 NEXT I
115 NEXT J
400 MAT X= TRN(P)
410 MAT Y=X*C —— —— —— —— Calculation of P[Φ_k, X̄_k]
412 PRINT
414PRINT"PHASE OCCURRENCE WITH FAILURE PROBS."
416 MAT PRINT Y
421 MATZ=Y*S — — — —— —— Calculation of P[Q, X̄]
452 PRINT
453 PRINT"TOTAL ACCIDENT PROB. THEOR. IS";Z(1,1)
455 PRINT
500 IF D1<N3 THEN 13
520 RESTORE
600 DATA .666667,.3333333,1.0
610 DATA .20,.10,.05
620 DATA .25,.25,.32
999 END
```

Routine for calculating $C(k,j) = P[\Phi_j \mid \bar{X}_k]$

Figure E-2. BASIC Program for Obtaining Overall Element Criticality Values

```
    0F PHASES AND N0. 0F C0MPONENTS ARE ?3,1

C0MPONENT N0. IS     1

PHASE TRANSITI0N MATRIX  P[i, j|x̄_L, ā]

P(     1      2 ) =     0.666667
P(     1      3 ) =    0.3333333
P(     2      3 ) =       1

FIRST-FAIL PR0BS  P[x̄_k']

          0.2

          0.1

          0.05

PHASE SENSITIVITIES  S_k = P[a_k|x̄_k]

          0.25

          0.25

          0.32

PR0B. PHASE J 0CCURS GIVEN FAILURE EXISTS IN PHASE K  P[φ_j|x̄_k]
     1      2 C(K,J)  0.5000002
     2      3 C(K,J) 0.75
     1      3 C(K,J)  0.6250002

PHASE 0CCURRENCE WITH FAILURE PR0BS.  P[φ_k, x̄_k]

          0.2              0.2              0.25

T0TAL ACCIDENT PR0B. THE0R. IS 0.18
```

Figure E-3. Sample Program Output

Independent joint failure occurrences can be considered in a manner similar to that described in Section E.1, but only at a considerable increase in complexity. The simplest case would be to assume independence of accident sensitivities such that:

$$P(\mathcal{A}_k|\overline{X}_k, \overline{Y}_k) = S_k(\overline{X}, \overline{Y}) = 1 - [1 - S_k(\overline{X})][1 - S_k(\overline{Y})].$$

Under this assumption, the additional model complexity involves considering the additional $\binom{M}{2}$ possible joint-failure occurrences (where M = number of elements), and the additional $\binom{M}{2}$ phase transition matrices. Since M is quite large, such inclusion results in a greatly expanded problem.

If accident-sensitivity independence is not assumed (and realistic consideration would lead to such conclusion for many cases), the problem could well become unsolvable in the practical sense. Since the major purpose of the analysis is to determine criticality rankings, consideration of only single-failure occurrences is not unreasonable, especially in terms of the amount of effort and knowledge required to do otherwise. It is noted however that if certain elements or functions are known to be quite interactive, new pseudo-elements may be defined to handle joint occurrences for these cases. For example, if X and Y have a pronounced interaction effect with respect to accident probability, one can introduce the pseudo-elements:

$$\overline{Z}_1 = \overline{X}Y, \quad \overline{Z}_2 = X\overline{Y}, \quad \overline{Z}_3 = \overline{XY}$$

and sensitivities for $\overline{Z}_1, \overline{Z}_2, \overline{Z}_3$ can be developed to account for the interactive effect.

Condition 2: The first failure probabilities are a function of phase-transition probability and element reliability. In general

$$P(\overline{X}_k) = P(X \text{ first fails in } k^{th} \text{ phase}) = \frac{(\text{No. of flights in which X first fails in phase k})}{(\text{total No. of flights})}$$

A model for $P(\overline{X}_k)$ considering a three-phase mission can be presented as follows.

Let t_1, t_2, t_3 represent the duration of the three phases; and let $F(t_k|t_j)$ represent the probability that the element fails within t_j to $t_j + t_k$, given that it has survived

over t_j operating hours; and let $\overline{F} = 1 - F$. Then, assuming a "new" element X at the start of the mission,* we have

$$P(\overline{X}_1') = P(\phi_1)F(t_1|0) = F(t_1|0) \qquad [P(\phi_1) = 1.0]$$

$$P(\overline{X}_2') = P(\phi_1)\overline{F}(t_1|0)P(1,2|X_1,\phi_1)F(t_2|t_1)$$

$$P(\overline{X}_3') = P(\phi_1)\overline{F}(t_1|0)\{P(1,2|X_1,\phi_1)\overline{F}(t_2|t_1)P(2,3|X_2,\phi_2)F(t_3|t_1+t_2)$$

$$+ P(1,3|X_1,\phi_1)F(t_3|t_1)\}$$

If we assume a "standard mission" in which all phases are performed in sequence unless a failure occurs, i.e.,

$$P(\phi_j|X_i) = \begin{cases} 1, & \text{for } j=i+1 \\ 0, & \text{otherwise} \end{cases}$$

then

$$P(\overline{X}_1') = \overline{F}(t_1|0) = 1 - R(t_1)$$

$$P(\overline{X}_2') = \overline{F}(t_1|0)F(t_2|t_1) = R(t_1) - R(t_1+t_2)$$

$$P(\overline{X}_3') = \overline{F}(t_1|0)F(t_1|t_1)F(t_3|t_1+t_1) = R(t_1+t_2) - R(t_1+t_1+t_3)$$

where $R(t)$ = P (successful operation over t hours).

The above two sets of equations for $P(\overline{X}_1')$ can be easily extended to k-phase missions. Both cases require a reliability model for the element. For example, if a constant failure rate (λ) can be assumed, then a particularly simple relationship holds:

$$F(t_k|t_j) = 1 - e^{-\lambda t_k}$$

More complex types of failure densities (e.g., those accounting for wearout such as in mechanical components), and consideration of the varying stresses on elements during different phases, can be incorporated into the reliability model as applicable.

*If, in fact, T total hours have been accumulated beforehand, replace $F(t_1|0)$ by $F(t_1|T)$, $F(t_2|t_1)$ by $F(t_2|T+t_1)$, etc.

If the standard-mission case is not to be considered, then analysis of past flights and future expected operational profiles will have to be conducted in order to estimate the appropriate phase-transition probabilities required for the $P(\overline{X}_k')$ model.

Condition 3: Repair or restoration of failed elements is assumed not to occur. Although certain types of failure can sometimes be repaired in flight, and although some types of failure are of an intermittent nature, the relative occurrence of these events is generally small relative to failures that cannot be restored or repaired. Since critical elements generally have backup or redundant functions (which are considered in the sensitivity model), it is believed that this assumption is not too serious for the purpose of criticality ranking, especially in view of the model and data-requirements complexity that would result if the assumption were not made.

E.4 MODEL APPLICATION

E.4.1 Combining Data and Model Estimates of Sensitivity

As shown in Section E.1, two equivalent equations for obtaining overall element criticality as a function of estimated phase sensitivities can be developed. They are:

Equation A:

$$P(\mathcal{A}, \overline{X}) = \sum_{k=1}^{n} P(\overline{X}_k, \Phi_k) S_k$$

Equation B:

$$P(\mathcal{A}, \overline{X}) = \underline{P}\,\underline{C}\,\underline{S}$$

where $\underline{P}$, $\underline{C}$, and $\underline{S}$ are as defined on page E-5. If no data are available on the system under consideration then equation B would apply, based on predicted values of $P(\overline{X}_i')$ and $P(i, j | \overline{X}_i, \mathcal{A})$ for developing the $\underline{P}$ and $\underline{C}$ matrices.

If applicable system data are available, then observed values of $P(\overline{X}_k, \Phi_k)$ can be obtained and equation A employed. This, of course, is desirable since it eliminates errors in estimates of first-failure and transition probabilities. It is noted, however, that this approach involves combining two types of sensitivity values. From the equations in Section E.1, it can be shown that

$$P(\overline{X}_k, \Phi_k) = \sum_{i=1}^{k-1} \sum_{j=i+1}^{k} P(\overline{X}_i')(1-S_i) P(i, j | \overline{X}_i, \mathcal{A}) P(\Phi_k | \overline{X}_j) + P(\overline{X}_k')$$

Thus, estimates of $P(\overline{X}_k, \Phi_k)$ from observed data already include actual sensitivity values--the $(1-S_i)$ factor in the above equation. If we use the right-hand side of the above equation in Equation A, we have

$$P(\mathcal{A}, \overline{X}) = \sum_{k=2}^{n} \sum_{i=1}^{k-1} \sum_{j=i+1}^{k} P(\overline{X}_i')(1-S_i') P(i, j | \overline{X}_i, \mathcal{A}) P(\Phi_k | \overline{X}_j) S_k'' + P(\overline{X}_1') S_1'' + P(\overline{X}_n') S_n''$$

where S_j' is used to denote a sensitivity value inherent in the observed data, and S_j'' to denote a sensitivity value developed from functional analysis of the system.

As discussed previously, these two sensitivity values are not necessarily measures of the same event--the S_j'' values are more a measure of accident exposure or accident risk than true accident probability, of which the S_j' are representative.

The combination of observed $P(\overline{X}_k, \phi_k)$ and predicted S_k values is then appropriate in terms of developing criticality rankings of elements if there is a proportional relationship between the S_j' and S_j'' values--that is, if there exists for all phases and all elements a constant C such that $S_j'' = CS_j'$, for then the criticality of each element is multiplied by the C constant, thus leaving the rankings invariant.

It cannot be said with certainty that all the sensitivity estimates S_j'' for all elements and phases are in fact a simple multiple of the "true value". Rather it is more reasonable to assume that over some limited range there is a consistency; that is

$$S_j''(\overline{X}) = C_{j\overline{X}} S'(\overline{X})$$

where $C_{j\overline{X}}$ is the factor relating the estimate of the sensitivity of element x in the j^{th} phase to the true value, and $C_{j\overline{X}}$ has a relatively limited range that holds for all phases and elements.

To illustrate this point, Table E-1 presents appropriate model inputs for a five-element system involved in six phases. It is assumed that $1.0 \leq C_{j\overline{X}} \leq 1.2$, and random numbers chosen within this range were used to obtain the $S_j''(\overline{X})$ values. Table E-2 shows the two sets of criticality numbers and relative rankings of the elements.

It is seen that in this example the rankings are the same for both cases. Naturally this does not provide assurance that this will always be the case, but it can be reasonably conjectured that if the $C_{j\overline{X}}$ range is not too large and the factor is uniformly distributed for any $(j, \overline{X})$ combination, then any change in rankings will be relatively minor.

E.4.2 Implementation Example

The Functional Criticality Model was exercised using Navy 3M* data and sensitivities for the Work Unit Code items of the F-4J aircraft as part of a concurrent Navy contract.

To evaluate the inputs to the model, a data survey was conducted of the Naval Safety Center's data bank. The survey revealed that the data bank was adequately recording the malfunctions registered by the 3M system, and the capability already exists within the Center for computing mean time between failure (MTBF) from 3M failure information coupled with flight times reported on pilot debriefing forms. As in the case of the Air Force math model (designed for application to the AFM 66-1 data system), the "When Discovered" codes used in the 3M system are inadequate for describing the portion of the flight in which an aircraft is exposed to malfunctions -- a basic input to the safety-prediction math model.

*Department of the Navy, Naval Aviation Maintenance and Material Management Manual, Publication 0618-200-0100.

TABLE E-1. DATA INPUTS TO ILLUSTRATIVE PROBLEM

(Five-Element System Involved in Six Phases)

A. Phase Transition Matrices

Element 1

P(	1	2) =	0
P(	1	3) =	0
P(	1	4) =	0
P(	1	5) =	0
P(	1	6) =	1
P(	2	3) =	0
P(	2	4) =	0
P(	2	5) =	1
P(	2	6) =	0
P(	3	4) =	1
P(	3	5) =	0
P(	3	6) =	0
P(	4	5) =	1
P(	4	6) =	0
P(	5	6) =	1

Element 2

P(	1	2) =	0.7
P(	1	3) =	0
P(	1	4) =	0
P(	1	5) =	0
P(	1	6) =	0.3
P(	2	3) =	0.2
P(	2	4) =	0
P(	2	5) =	0.8
P(	2	6) =	0
P(	3	4) =	1
P(	3	5) =	0
P(	3	6) =	0
P(	4	5) =	1
P(	4	6) =	0
P(	5	6) =	1

Element 3

P(	1	2) =	0.2
P(	1	3) =	0
P(	1	4) =	0
P(	1	5) =	0
P(	1	6) =	0.8
P(	2	3) =	0.1
P(	2	4) =	0
P(	2	5) =	0.9
P(	2	6) =	0
P(	3	4) =	1
P(	3	5) =	0
P(	3	6) =	0
P(	4	5) =	1
P(	4	6) =	0
P(	5	6) =	1

Element 4

P(	1	2) =	0.2
P(	1	3) =	0
P(	1	4) =	0
P(	1	5) =	0
P(	1	6) =	0.8
P(	2	3) =	0.2
P(	2	4) =	0
P(	2	5) =	0.8
P(	2	6) =	0
P(	3	4) =	1
P(	3	5) =	0
P(	3	6) =	0
P(	4	5) =	1
P(	4	6) =	0
P(	5	6) =	1

Element 5

P(	1	2) =	0
P(	1	3) =	0
P(	1	4) =	0
P(	1	5) =	0
P(	1	6) =	1
P(	2	3) =	0
P(	2	4) =	0
P(	2	5) =	1
P(	2	6) =	0
P(	3	4) =	1
P(	3	5) =	0
P(	3	6) =	0
P(	4	5) =	1
P(	4	6) =	0
P(	5	6) =	1

B. First-Failure Probabilities

Phase	Element				
	1	2	3	4	5
1	0.02	0.01	0.02	0.01	0.01
2	0.01	0.01	0.01	0.01	0.02
3	0	0.01	0.01	0.02	0.03
4	0	0.01	0.01	0.02	0.03
5	0	0.01	0.01	0.02	0.02
6	0.03	0.02	0.02	0.01	0.02

(Continued)

TABLE E-1. (Continued)

C. Phase Sensitivities										
	Element									
	1		2		3		4		5	
Phase	S'	S''	S'	S''	S'	S''	S'	S''	S'	S''
1	0.8	0.88	0.2	0.23	0.3	0.388	0.1	0.102	0	0
2	0	0	0	0	0.4	0.444	0.1	0.117	0	0
3	0	0	0	0	0.1	0.111	0.1	0.104	0.2	0.238
4	0	0	0	0	0.1	0.107	0.1	0.116	0.2	0.224
5	0	0	0	0	0.5	0.565	0.1	0.107	0	0
6	0.9	0.918	0.5	0.52	0.3	0.327	0.2	0.234	0	0

TABLE E-2. CRITICALITY VALUES AND RANKINGS FOR TWO CASES

Case 1 – Only S' Values Used in Equation A			Case 2 – S' and S'' Values Used in Equation A		
Element	Criticality	Rank	Element	Criticality	Rank
1	0.0556	1	1	0.0582	1
2	0.0360	3	2	0.0377	3
3	0.0460	2	3	0.0508	2
4	0.0299	4	4	0.0338	4
5	0.0168	5	5	0.0192	5